YUHA BASIN

PROPOSED GEOTHERMAL LEASING Environmental Assessment Record Final

ES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT RIVERSIDE DISTRICT

--- ERRATA SHEET ---

The eight prime habitat sections in the study identified on page 53 of the Final EAR should read:

a. T. 17S., R. 11E., Section 23;

b. T. 17S., R. 12E., Sections 10, 11, 13, 15, 18, and 21;

c. T. 16S., R. 12E., Section 31.

A supplemental map delineating prime habitat of the flat-tailed horned lizard within the proposed leasing area will be issued to all recipients receiving a copy of the Final EAR.

FINAL

ENVIRONMENTAL ASSESSMENT RECORD

YUHA BASIN/MT. SIGNAL

NON-COMPETITIVE LEASES

FOR

GEOTHERMAL EXPLORATION/DEVELOPMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF MAPS

LIST OF APPENDICES

YUHA BASIN/MT. SIGNAL GEOTHERMAL
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I. INTRODUCTION AND DESCRIPTION OF PROPOSED ACTION

A. Introduction

This Environmental Assessment Record (EAR) is prepared in response to applications received by BLM for the non-competitive lease of federal lands. The purpose of obtaining these proposed leases is for the exploration and possible development of apparently existing geothermal resources.

Twelve non-competitive geothermal lease applications, divided into two lease blocks, will be considered by this EAR. These lease blocks are located north and northeast of Mt. Signal in the Yuha Basin of Imperial County, California (See Map I-1).

An area comprised of 10,021 acres of non-federal land and 42,912 acres of federal land has been designated as the study area (See Map I-2). The lease application only covers 21,332 acres of the study area. The larger study area was established to assure that any future geothermal activities which might result from this initial investigation will have been considered and to assure the accuracy of the impact investigations done as a part of this documentation.

This EAR analyzes the possible impacts that could occur as a result of the proposed leasing action. This document is subject to public review and comment. BLM management will use this document as the primary factor in determining:

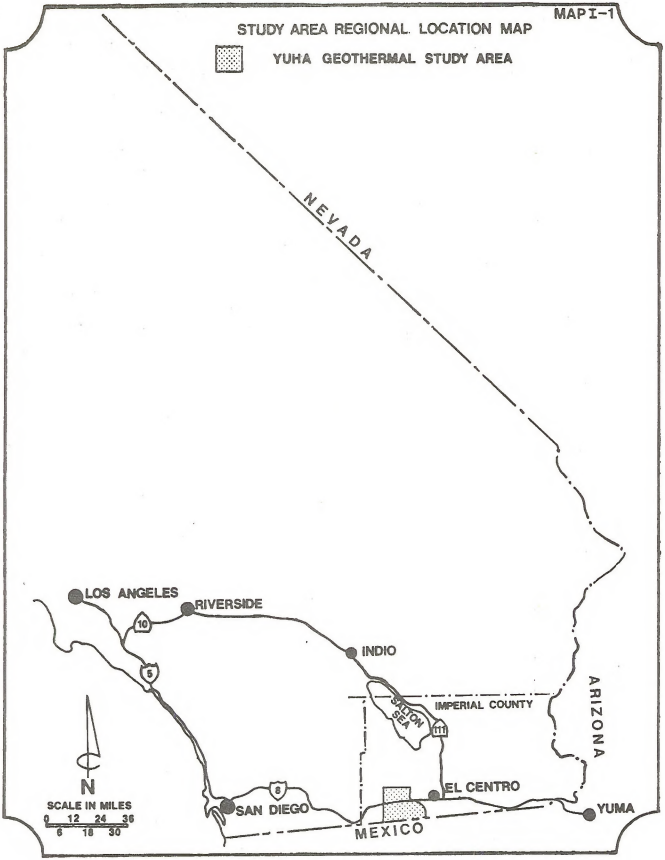
1) The sensitivity of the study area to geothermal development intrusion;

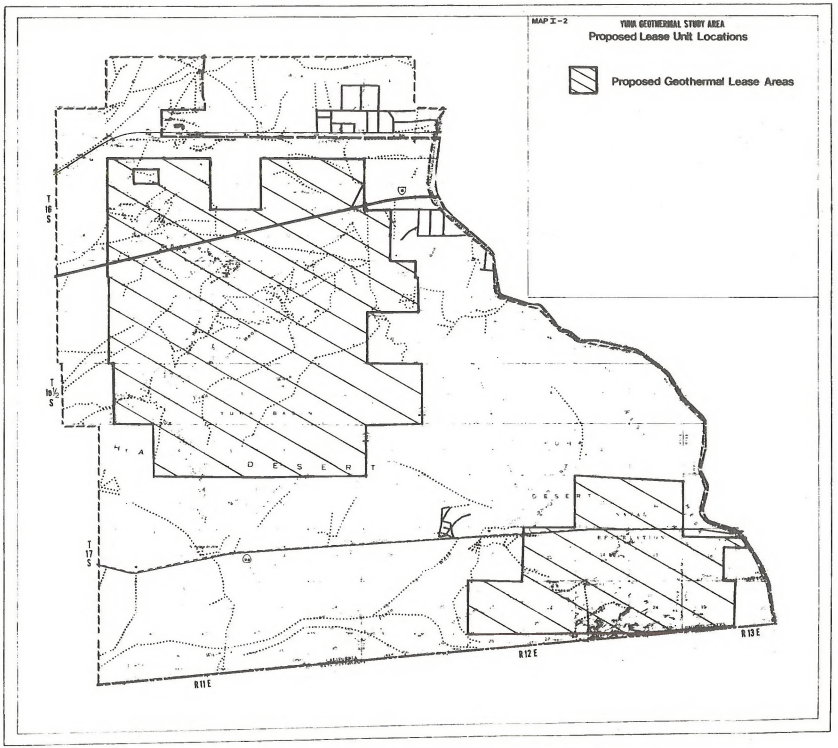
2) The need for further study through the more extensive address of an Environmental Statement (ES); and

3) if leasing should occur, under what conditions shall leasing be allowed.

The initial overview of the study area by the EAR team has indicated possible significant environmental problems arising from the addition of geothermal development to the Yuha/Mt. Signal Area. Existence of several valuable resources (flora, fauna, cultural, recreation, visual) present a high possibility of conflict with the addition of the geothermal industry.

Prior to proceeding with the draft EAR, a letter requesting concerns and information was sent to all parties appearing on the mailing list (Appendix D). A public meeting was advertised and held during the public review period. Response to both of these public input efforts was minimal, indicating either a lack of concern by the general public or the inability of BLM to gather public comment.


MAP I-1
STUDY AREA REGIONAL LOCATION MAP
YUHA GEOTHERMAL STUDY AREA
NEVADA
LOS ANGELES
RIVERSIDE
INDIO
SALTON SEA
IMPERIAL COUNTY
ARIZONA
EL CENTRO
SAN DIEGO
YUMA
MEXICO
N
SCALE IN MILES
0 12 24 36
6 18 30


MAP I - 2
YUMA GEOTHERMAL STUDY AREA
Proposed Lease Unit Locations
Proposed Geothermal Lease Areas
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
D E S E R T

B. Background

Development of geothermal resources involves the harnessing of natural heat energy in the earth for generation of electricity and production of commercially valuable by-products, although knowledge of this resource is still being developed.

Geothermal resources are recoverable, stored heat (White & Williams, 1975), occurring in four systems: vapor-dominated, hot-water, geopressured reservoir, and hot dry-rock. Hot-water systems are the most common and are suspected to exist in the EAR area.

In this system, circulating liquid transmits heat and controls subsurface pressure (White & Williams, 1975). Thermal energy is stored in hot rock and is transferred to the fluid that fills the pores and voids in the rock. When the circulating fluids are tapped by drill holes, the fluid may flash to steam because of the pressure decrease experienced within an open drill bore. This steam can be used to do work such as turn a turbine to develop electrical power.

C. Proposed Action and Alternatives

The BLM is proposing to release federally-owned land to non-competitive lease action, in response to applications received from parties interested in exploring for and possibly developing geothermal resources. The property involved in this lease action is located within the Yuha Basin--north and east of Mt. Signal, on the west mesa of the Imperial Valley, California. (See Map I-2.)

The prospective lessee is proposing to explore for and possibly develop an apparent geothermal resource for the purpose of generating electrical energy for local use and possible export.

The development model (Part D) describes the surface disturbances and technical activities necessary to complete the development of a geothermal power plant on each of the lease areas. Through investigation of leasing procedures it has become obvious that there are three (3) alternative decision actions that can be made by BLM management.

1. Alternative No. 1

Leasing of all lands, as applied for, with all stipulations of the Geothermal Resource Operational Orders (GRO Orders) applied through the required additional environmental review.

This alternative would provide for maximum flexibility in surface management of those surface disturbances associated with geothermal development.

The environmental impacts of such development would be controlled under the GRO Order No. 4 using the standard environmental protection stipulations developed as mitigation measures in subsequent environmental reviews.

2. Alternative Action No. 2

Leasing of all geothermal resources while restricting surface access.

This alternative would provide for the exploitation of the geothermal resource by minimizing surface disturbances through the following restrictive measures.

a) The use of well islands and directional drilling techniques.

b) The limitation or denial of surface access in identified highly sensitive resource areas.

c) Permanent development will be restricted to non-sensitive areas unless access to sensitive areas is shown to be necessary for the technical development of the geothermal resource.

This alternative is developed as a measure to protect the habitat of the flat-tailed horned lizard and the extensive cultural values existing in the area. The lizard is protected by the State of California and is currently under status review by the U.S. Fish and Wildlife Service. The study area also contains many cultural values and is currently being reviewed as a potential National Register District.

3. Alternative Action No. 3

Decision not to lease.

This alternative would not permit the applicant to lease the subject property for the purposes of geothermal resource exploration and development, thereby maximizing protection of all sensitive resource values at the expense of geothermal resource development.

D. Development Model

It is difficult to quantify the extent and potential of the geothermal resource of the study area without additional down hole investigations and resource testing. The environmental impacts resulting from these investigations also cannot be assessed without making a base assumption as to the possible development intensity.

Studies of like actions on the East Mesa (EA#78 & 99-100 et.al., USDI-GS Conservation Division, Office of the Area Geothermal Supervisor, Menlo Park, California) demonstrated the possible sequence of events leading through development of this resource. Thus, a geothermal resource development baseline has been set at one (1) fifty megawatt (50 MW) generation facility on one (1) 2,560 acre lease, located in each of the

two (2) lease areas for a total generation capacity of 100 MW. It is also assumed that each of these leases will progress, sequentially, through five (5) interdependent development stages.

The true land area to be disturbed by the proposed geothermal development activities cannot be determined without more accurate description of locations, accesses, project types, and sizes. For the purpose of this EAR, 10-20 percent of the lease area is assumed to be directly affected by this proposed action (200-400 acres), while a much greater area within the study area could be indirectly affected by the proposed action (400-800 acres).

The economic life of the proposed geothermal development cannot be accurately estimated due to a need for more data on the size, temperature, and type of resource available. However, for the purpose of this Environmental Investigation the 30 year economic life of the generation equipment will be the base from which estimates of time tables will be made.

1. Preliminary Exploration

The technical requirements of this stage involve many activities ranging from airborne exploration, topographical and geological mapping, geophysical exploration, and geochemical surveys, to drilling shallow ($\pm$500') seismic and temperature gradient holes. Most of these activities involve small crews of two or three people and small trucks for transportation of the crew and truck-mounted and hand-held equipment. The existing roads and trails system within the study area could accommodate these vehicles. In depth discussions of preliminary exploration and mitigation taken by BLM can be found in EA #CA-060-GE7-6, Nov. 11, 1977, USDI-BLM, El Centro Area Office.

2. Exploration Drilling

This stage includes the drilling of geologic information holes, exploratory wells, and test flow operations. A basic requirement of this phase is the use of large drill equipment that is capable of reaching depths of 10,000 feet or more. Access roads and drilling sites will require extensive surface disturbance to accommodate this equipment. Drilling equipment, technology and methods are similar to oil and gas operations and many require as much as three acres of surface disturbance per well site plus access road development. (See EA #78).

3. Field Development

This phase will be dependent upon successful exploration drilling. Included in this stage are all activities from the decision to develop an identified resource to production of commercial power and its transmission. It is in this phase that the greatest impacts can occur. The power plant, transmission lines and well site will all be constructed and connected by a series of access roads. Concurrent with production activities, exploration will continue in an effort to find the limit of the resource. (See EA #78, #99-100)

4. Production and Operation

The activities in this stage will consist of the operation and maintenance of the power production system, the drilling of replacement wells, waste disposal, and water utilization. Full scale operations can be expected to continue for many years. Repair, maintenance, monitoring and operating field equipment will require periodic use of access roads by large scale equipment. Any power plant located on federal lands will require a license from BLM.

5. Closedown

Closedown and site abandonment will occur when it is determined that the resource is depleted. The economic life span of the resource has not yet been determined, but for the purposes of this EAR, 30 years is assumed. This is simply the amortization period of a steam plant. This phase will include the removal of all facilities, abandonment of all wells, and the rehabilitation of the impacted surface. Well abandonment and pad rehabilitation will also take place during phases 3 & 4. Site abandonment is required for bond release.

E. Interrelationships

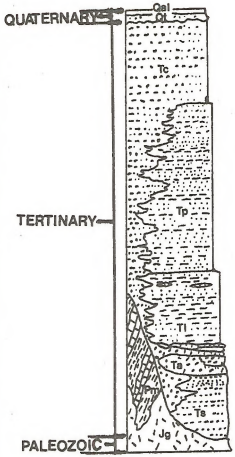
The applicant believes that a viable prospect exists in the study area and rates it as a high priority target in a statewide exploration program. The Yuha MFP has identified the study area as prospectively valuable for geothermal resources. These proposed lease actions will be the first step in defining more accurately sources of geothermal energy potential within the Yuha MFP study area.

The County of Imperial has promulgated a Geothermal Element to its County General Plan, and this Element sets forth the County's policy towards geothermal development and outlines its rules and regulations. These rules parallel the Geothermal Resource Orders issued by the US Geological Survey under the authority of the Geothermal Act of 1970 (PL91-581) that controls all operations on Federal geothermal leases. However, the County's Element does not presently recognize the Yuha Basin as a geothermal resource area.

The County General Plan, Open Space Element has placed most of the lease area into a protected status for cultural, ecological and other scientific sites. Imperial County is on record as officially favoring geothermal development, but only under closely regulated conditions.

If a lease is awarded, the US Geological Survey (GS) becomes the lead agency, in the preparation of the additional required EA's soliciting input from all responsible and concerned agencies. Prior to any activity on the lease, the lessee must submit detailed plans of operation (PO) to the GS who subsequently prepares an EA which specifically addresses the impacts of the identified activity in the PO. All POD EARs are prepared in cooperation with BLM and BLM's signatory to approval of surface management. Subsequent phases of development are addressed in a like manner.

The federal geothermal leasing program is governed by the Geothermal Steam Act of 1970 (Public Law 91-581), and is implemented in accordance with the geothermal leasing and operating regulations contained in 43 CFR Part 3200 and 30 CFR Parts 270 and 271 (see Geothermal Handbook (NP-21172) Chapter II, pages 73-84, US Fish and Wildlife Service).



(after Dibblee, 1954)

ALLUVIUM AND TERRACES (Qal. Qt) 0-300 feet gravel, sand unconformity

CANEBRAKE CONGLOMERATE (Tc) 0-9,000 feet gray conglomerate of granitic and metamorphic debris, grading westward into massive granitic fanglomerate.

PALM SPRING FORMATION (Tp) 0-6,500 feet interbedded light gray arkosic sandstones and reddish clays; terrestrial; grades westward into Canebrake Conglomerate.

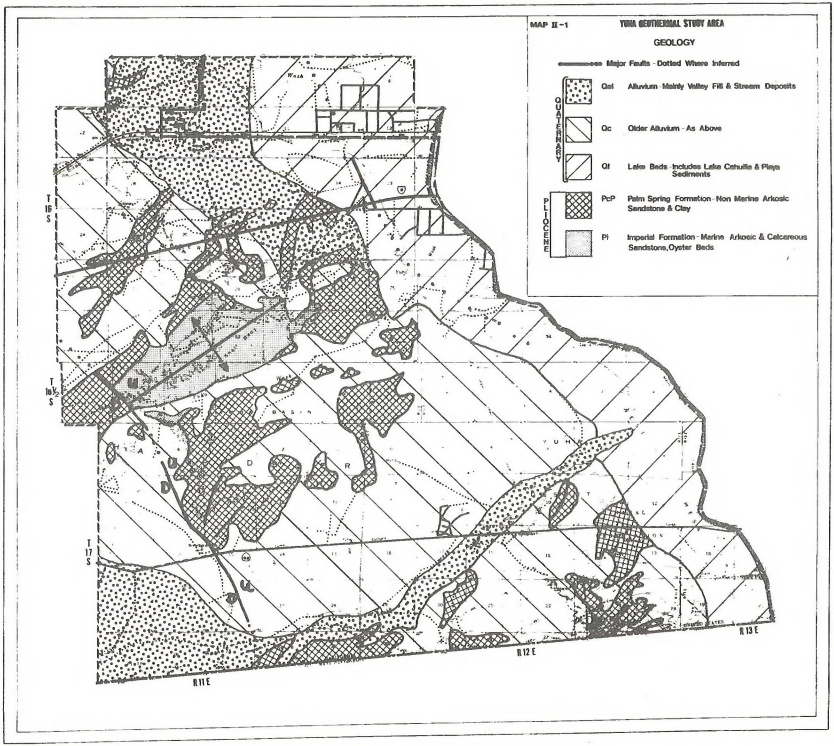
IMPERIAL FORMATION (Ti) 0-3,800 feet light gray claystone and lesser interbedded arkosic sandstones: calcareous oyster-shell reefs common; basal 0-50 foot bed of fossiliferous calcareous sandstone; marine.

FISH CREEK GYPSUM (Tf) 0-100 feet (Fish Cr. Mtns. only)

ALVERSON ANDESITE (Ta) 0-700 feet andesite lava, breccia, and tuff.

SPLIT MOUNTAIN FORMATION (Ts.) 0-2,700 feet gray conglomerate of granitic debris, dioritic breccia, hard buff sandstone, red arkosic sandstone and conglomerate.
unconformity
SCHIST, LIMESTONE; GNEISS: GRANTIC INTRUSIVES

TABLE II-1 General Columnar Section


MAP II-1
TWA GEOTHERMAL STUDY AREA
GEOLOGY
Major Faults - Dotted Where Inferred
QUATERNARY
Qal Alluvium - Mainly Valley Fill & Stream Deposits
Qc Older Alluvium - As Above
Ql Lake Beds Includes Lake Cahuilla & Playa Sediments
PLIOCENE
PcP Palm Spring Formation - Non Marine Arkosic Sandstone & Clay
Pi Imperial Formation - Marine Arkosic & Calcareous Sandstone, Oyster Beds
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E

The clay, shale, and silt beds of these two formations form unstable slopes, which have eroded into a mini-badlands type topography around the Yuha Buttes area. The whole area is intersected by numerous sediment filled dry wash channels.

Other, less well-defined, younger stratigraphic units of stream and alluvial deposits composed of various sands, clays, and occasional gravel beds overlay the Imperial and Palm Springs Formations. The youngest unit in the area is the Lake Cahuilla Formation composed of fertile lakebed clays and silts which form the prime agricultural land of Imperial County.

4. Geologic Hazards

a. Seismic Activity and Faulting

The entire Imperial Valley is seismically active. Geophysical studies (Black, 1974) indicate that buried ridges and valleys will continue to be potentially active over the next several centuries. Earthquake intensities are expected to range from V to IX on the Modified Mercalli Scale (California Division of Mines and Geology, 1973).

b. Slope Stability

The two major formations are composed of unconsolidated sandstones, siltstones and clays, and slopes formed by these units will be unstable subject to rapid erosion, landslides and washouts.

c. Washes and Flood Plains

Flood plains are not easily identified in the study area although Pinto, Yuha and Coyote Washes serve as the major surface water flow corridors. Large volumes of water have been observed in these washes during the rainy winter season when flash flooding is common.

d. Subsidence

Naturally occurring subsidence is a major phenomenon in the Imperial Valley at this time. A reference bench mark for the US Geological Survey's leveling net has been established in the study area as part of the Imperial Valley monitoring program.

5. Ancient Freshwater Lakes

Several freshwater lakes have covered the Imperial Valley and portions of the study area in the past. During Pleistocene times Lake LeConte inundated the region. Several individuals have postulated the age and extent of this lake but an adequate history has not been constructed. This lake may have had an important effect on man's entrance into the area.

Another more recent lake to occupy the area was Lake Cahuilla that began filling shortly after 100 AD. During its tenure, it had at least three high water stands. Desiccation of this lake took place 500 to 550 years ago. Sand and gravel production is the predominate minerals activity along the lake shoreline.

B. Hydrology

1. Drainage Basin

The study area's natural surface drainage is into the Salton Sea. Most of the basin is extremely arid and the natural runoff from sparse rainfall is insufficient to maintain a permanent body of water (Map II-2).

2. Ground Water

a. Aquifers

Three broad categories of non-crystalline rock occur in the study area. The lower, a Miocene sequence layer of non-marine sedimentary rock, is too deep to be a ground water source, and has sediments of low permeability which may contain saline water (USDI, USGS, 1977). The middle layer is the Imperial Formation composed of saline marine sediments with low permeability. These beds form the floor of the ground water reservoir.

The non-marine ancient Colorado River deltaic sedimentary deposit, which form the upper layer of the Pliocene sequence, makes up the main part of the ground water reservoir under the Imperial Valley.

The Elsinore-Laguna Salada Fault system and structural folds act as a barrier to horizontal ground water movement in the area (Skrivan, 1977), separating potable water on the west side from the saline water on the east.

b. Ground Water Quantity

There is an estimated 640,000 acre-feet of ground water in the upper 200 feet of the saturated sediments west of the fault system (Skrivan, 1977), and less than five percent of the total surface and ground water flow entering the Salton Sea is from this reservoir (Hely, et. at., 1966).

There are also many flowing domestic wells in the area west of the fault system. In 1975, the annual pumpage in the area, mainly around Ocotillo, was 880 acre-feet. The estimated recharge from mountain runoff is 2,600 acre-feet per year. See Table II-2 for 1975 water table figures.

On the east of the fault system, actual amounts of the ground water are not known, and more than half of the wells drilled in search of water for the area have been dry.

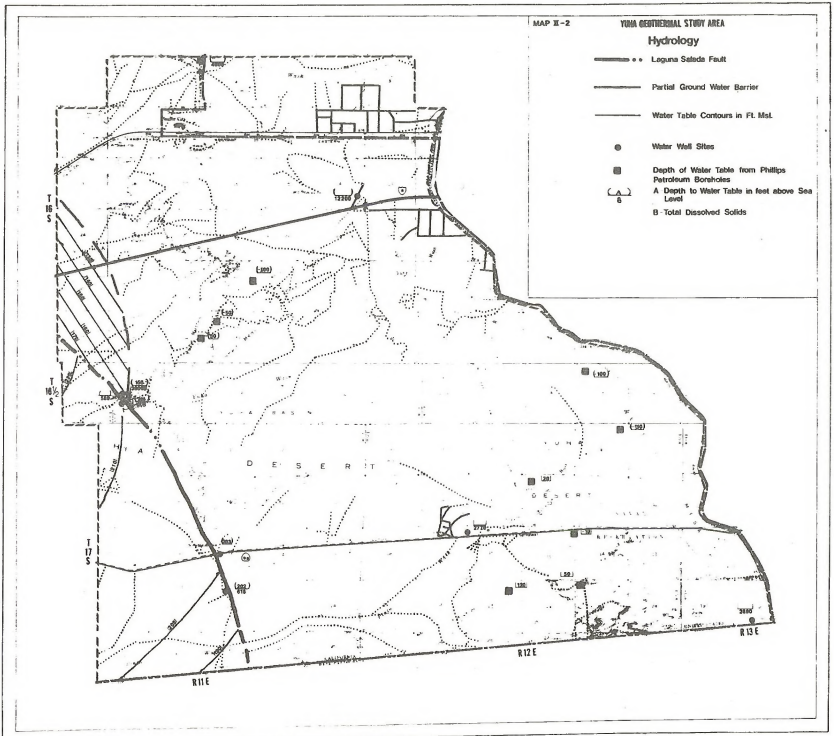

MAP II-2
YUMA GEOTHERMAL STUDY AREA
Hydrology
Laguna Salada Fault
Partial Ground Water Barrier
Water Table Contours in Ft. MsL
Water Well Sites
Depth of Water Table from Phillips Petroleum Boreholes
A Depth to Water Table in feet above Sea Level
B Total Dissolved Solids
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
D E S E R T

TABLE II-2

Ocotillo-Coyote Wells basin water budget for steady state (1925) and 1975

(Acre-feet per year)

Item	Steady state (1925)	1975
Recharge		
Infiltration of precipitation	2,600	2,600
Discharge		
Pumpage	0	900
Evapotranspiration	650	300
Underflow to Mexico	1,500	1,450
Underflow eastward across faults	450	450
Total discharge	2,600	3,100
Change in storage	0	-500

c. Ground Water Recharge and Movement

Annual rainfall of four to six inches on the Jacumba and Coyote Mountains provides an estimated 2,600 acre-feet of recharge water for the west aquifer. The subsurface loss of fresh water to Mexico is estimated at 1,500 acre feet per year.

The only available recharge on the east is the variable annual rains averaging three inches (3") plus storm runoff from the west. The amount of runoff that penetrates is unknown.

It is suspected that deeper amounts of ground water east of the fault flow east and north (Hely, et. al., 1966); if a geothermal system is located in the study area, the deeper waters will be drawn into it.

d. Ground Water Quality

Waters west of the fault system are potable and are classified as of the sodium bicarbonate type. There is a general increase in flouride content as samples move towards the mountains (Skrivan, 1977). These waters meet the EPA (1979) standards for drinking water and are used by the local communities (Ocotillo and Coyote Wells). The US Gypsum Company also uses this water for its operations.

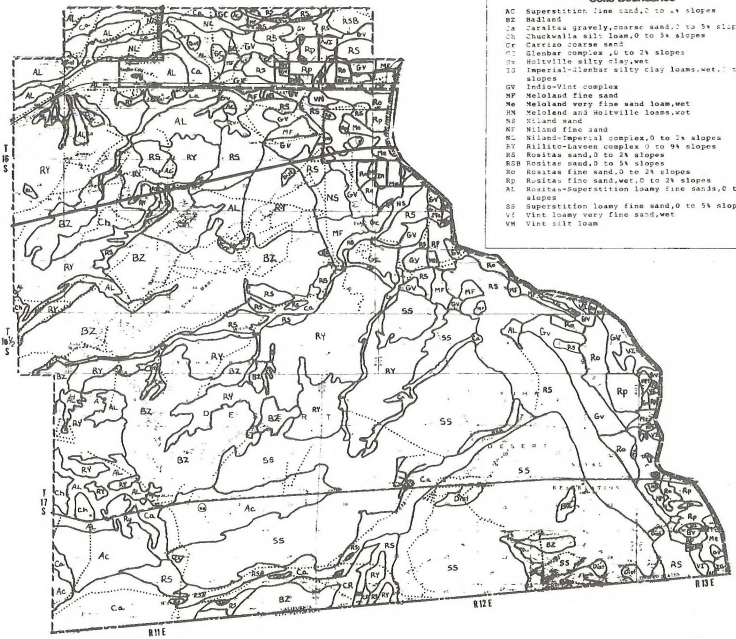
East of the fault, the ground water that has been tapped is saline with some flouride and is classified as being of the sodium-chloride-sulfate type and is not suitable for domestic consumption. This water is not used at this time, but could be used for industrial cooling purposes if a large volume of low salinity water is found. Down hole temperatures of wells east of the fault have averaged 25°C.

3. Surface Water

Regional surface waters are dominated by the Imperial agricultural irrigation and drainage system and the Salton Sea. Perennially flowing streams do not exist within the region. The West Side Main Canal is located on the east boundary of the study area. During periods of precipitation large volumes of water may appear in any of the washes which drain the study area. After any rain, temporary bodies of water will form, but the water is saline and not of potable quality. Located centrally in the north lease area (Yuha Buttes) are historic and aboriginal well sites, each of which have recently produced potable water.

C. Soils

The Yuha URA (1974) covers the soils in the area with the exception of some private land near the West Side Main Canal. This area has been mapped with data from the completed, but not published, soil survey of the Imperial Valley. Soil boundaries are shown on Map II-3, and characteristics and qualities are given in Appendix A.


MAP II-3
YUMA GEOTHERMAL STUDY AREA
Soils Boundaries
AC Superstition fine sand,0 to 2% slopes
BZ Badland
Ca Carsitas gravelly,coarse sand,0 to 5% slopes
Ch Chuckwalla silt loam,0 to 3% slopes
Cr Carrizo coarse sand
Gl Glenbar complex,0 to 2% slopes
Hv Holtville silty clay,wet
IG Imperial-Glenbar silty clay loams,wet, to 2% slopes
GV Indio-Vint complex
MF Meloland fine sand
Me Meloland very fine sand loam,wet
MN Meloland and Holtville loams,wet
Ns Niland sand
NF Niland fine sand
NL Niland-Imperial complex,0 to 2% slopes
RY Rillito-Laveen complex 0 to 9% slopes
RS Rositas sand,0 to 2% slopes
RSB Rositas sand,0 to 5% slopes
Ro Rositas fine sand,0 to 2% slopes
Rp Rositas fine sand,wet,0 to 2% slopes
RL Rositas-Superstition loamy fine sands,0 to 2% slopes
SS Superstition loamy fine sand,0 to 5% slopes
Vf Vint loamy very fine sand,wet
VM Vint silt loam
T 16 S
T 17 S
R 11 E
R 12 E
R 13 E

Soils with the greatest potential for compaction are those with a combination of fine and coarse particles which will allow packing of the fine material into the voids between the larger material. Loose sands and clays (especially those with particles of similar sizes) will have the least potential for compaction. Therefore, those soils with the least potential for compaction are: 1) Corrizo sand, 2) Meloland fine sand, 3) Niland fine sand, and 4) Rositas sand. Holtville clay will also have low potential for compaction, although not as low as the loose sands.

Compaction potential is not solely dependent upon soil factors. In fact, moisture and the amount of usage are of much greater importance in determining the compaction potential of surface areas.

D. Climate

Imperial County is dry with very hot summers and pleasant winters. A west wind prevails averaging 10-15 mph, but occasionally exceeding 50 mph. Rainfall varies from year to year, but it averages about three inches. The humidity averages 30 percent or less the year round, and the heat and dry air combine to produce a very high evaporation rate (+ 100 in/yr).

Inversion layers forming during the night are prevalent throughout the year. The bases of these layers may be on or near the surface and extend as high as 600 feet (180 meters) to 1,500 feet (450 meters). These inversions tend to be destroyed early in the day during summer, but persist throughout much of the day during the winter months (Dec., Jan., Feb).

E. Air Quality

The study area is located in the Southeastern Desert Air Quality Control Region, California. This air basin has been designated a Class II air quality basin under the E.P.A. significant air deterioration regulations.

The air quality for the study area is considered good, due primarily to the prevailing west winds. Some pollutants are transported into the area from Mexico when the wind is out of the southeast.

In the past year this air quality region was designated to be in non-attainment for those specific standards to be met by a Class II air basin for oxidant levels. The following tables present the standards for and measurements taken within this basin (Tables II-3, 4, 5).

F. Visual Resources

The study area was originally rated for visual resources by the Desert Planning Staff (DPS) and the Sundesert ES team. Results of these studies are shown on Maps II-4 and II-5. According to DPS ratings, a majority of the study area has been rated as 'C' or low scenic quality, with the Yuha Basin falling into the 'B' or medium scenic quality category.

TABLE II-3
AMBIENT AIR QUALITY STANDARDS
APPLICABLE IN CALIFORNIA*

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS CONCENTRATION(7)	METHODS(1)	FEDERAL STANDARDS (4) PRIMARY(2)(7)	SECONDARY(3)(7)	METHOD(5)
Photochemical Oxidants (Corrected for NO2)	1 hour	0.10 ppm (200 ug/m^3)	Neutral Buffered KI	160 ug/m^3(8)	Same as Primary	Chemiluminescent
Carbon Monoxide	12 hours	10 ppm (11 mg/m^3)	Non-dispersive Infrared Spectroscopy		Same as Primary Standards	Non-dispersive Infrared Spectroscopy
	8 hours			10 mg/m^3 (9 ppm)		
	1 hour	40 ppm (46 mg/m^3)		40 mg/m^3 (35 ppm)		
Nitrogen Dioxide	Annual Average		Saltzman Method	100 ug/m^3 (0.05 ppm)	Same as Primary Standard	Colorimetric Method Using NaOH
	1 hour	0.25 ppm (470 ug/m^3)				
Sulfur Dioxide	Annual Avg.		Conductimetric Method	80 ug/m^3 (.03 ppm)		Pararonsaniline
	24 hours	0.04 ppm (105 ug/m^3)		365 ug/m^3 (.14 ppm)		
	3 hours				1300 ug/m^3 (0.5 ppm)	
	1 hour	0.5 ppm (1310 ug/m^3)				
Suspended Particulate Matter	Annual Geometric Mean	60 ug/m^3	High Volume Sampling	75 ug/m^3	60 ug/m^3	High Volume Sampling
	24 hours	100 ug/m^3		260 ug/m^3	150 ug/m^3	
Lead (Particulate)	30-day Average	1.5 ug/m^3	High Volume Sampling Dithizone Method			
Hydrogen Sulfide	1 hour	0.03 ppm (42 ug/m^3)	Cadmium Hydroxide Streatan Method			
Hydrocarbons (Corrected for Methane)	3 hours (6-9 a.m.)			160 mg/m^3 (0.24 ppm)	Same as Primary Standard	Flame Ionization Detection Using Gas Chromatography
Sulfates	24 hours	25 ug/m^3	-	-	-	-
Visibility Reducing Particles	1 observation	Insufficient amount to reduce the prevailing visibility(6) to less than 10 miles when the relative humidity is less than 70%				

NOTES:

(1) Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board to give equivalent results at or near the level of air quality standard may be used.

(2) National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after the state's implementation plan is approved by the Environmental Protection Agency (EPA).

(3) National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by EPA.

(4) Federal Standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than on per year.

(5) Reference method as described by the EPA. An equivalent method" of measurement may be used, but must have a "consistent relationship to the reference method" approved by the EPA.

(6) Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

(7) Concentration expressed first in units in which it was promulgated. Equivalent units given in parenthesis are based upon a reference temperature of 25° C and a reference pressure of 760 mm of mercury.

(8) Corrected for SO_2 in addition to NO_2.

*Data from San Bernardino County, 1974.

TABLE II-4 ALLOWABLE POLLUTION INCREASES FOR VARIOUS AREA CLASSIFICATIONS

Pollutant	EPA Area Classification (see below) Class I (ug/m^3)	Class II (ug/m^3)	Class III *
Particulate matter:			
Annual geometric mean	5	10	*
24-hour maximum	10	30	*
Sulfur dioxide:			
Annual arithmetic mean	2	15	*
24-hour maximum	5	100	*
3-hour maximum	25	700	*

Area Classifications:

Class I: Areas in which almost any change in air quality is significant.

Class II: Areas in which determination accompanying well-controlled growth is considered insignificant; values shown are allowable increases over baseline concentrations.

*Class III: Areas where concentrations are limited to national air quality standards.

Source: Federal Register 1974

TABLE II-5 STATE MOBILE UNIT MONITORING DATA*
NEAR NILAND, WINTER 1976

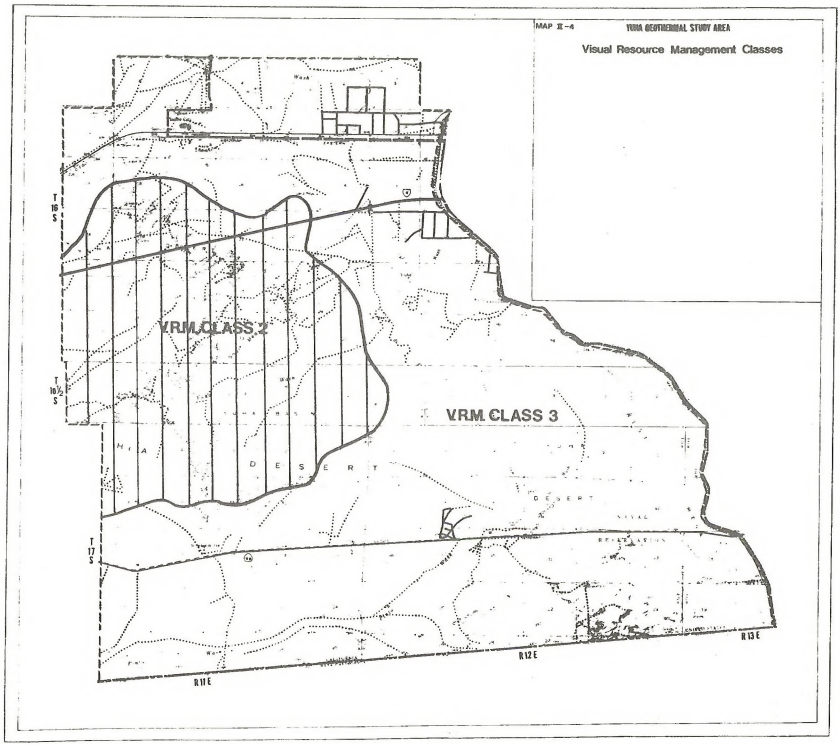
POLLUTANT	HOURLY CONCENTRATIONS LOW	AVERAGE	AVE. MAX. (1)	HIGH (2)	AIR QUALITY STANDARD
Ozone	0	0.02	0.04	0.10	0.08 (1 hr)
Carbon Monoxide	0	0.1	0.3	2	35 (1 hr)
Nitric Oxide (NO)	0	0.01	0.02	0.09	--
Nitrogen dioxide (NO_2)	0	0.01	0.02	0.09	0.25 (1 hr)
Nitrogen Oxides (NO_x)	0	0.02	0.04	0.11	--
Total sulfur	0	0.01	0.01	0.03	--
Hydrogen sulfide	0	0	0	0	0.33(1 hr)
Sulfur dioxide	0	0	0	0	0.5 (1 hr)
Total hydrocarbons	1.4	1.9	2.8	5.1	--
Methane	1.4	1.9	2.7	5.1	--
NMHC	0	0.1	0.1	1.1	0.24(3 hr)
Particulate matter	37	85	--	124	100 (24 hr)

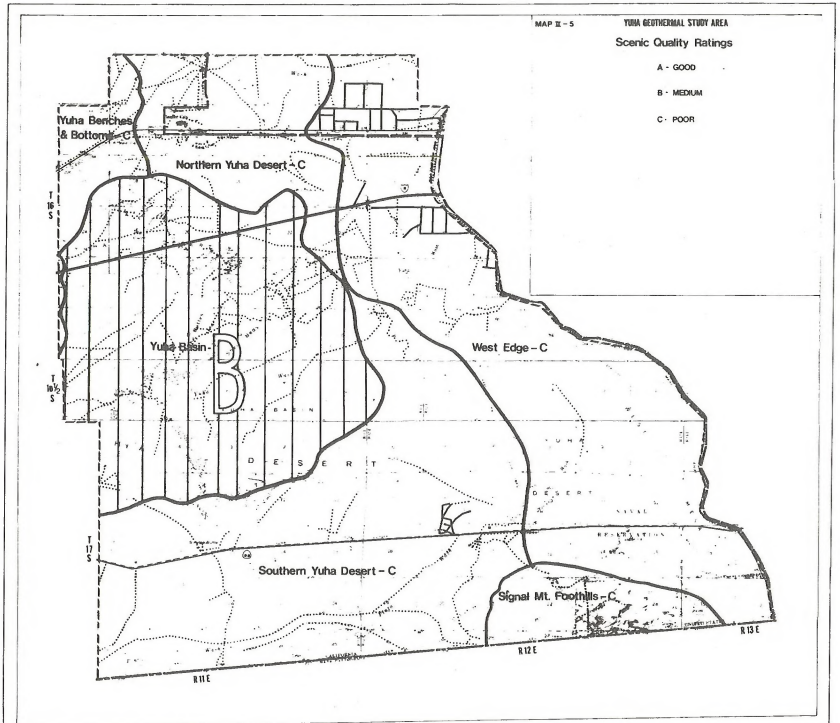
Notes: *One hour averages in units of parts per million by volume, except particulate matter which are 24-hour averages in units of uf/m^3.

(1) Average of daily maximum one-hour averages.

(2) Largest one-hour average for the period (early January through mid-March), except sulfur measurements (mid-February through mid-March).

Source: CARB (1975) California Air Quality Data, Vol. 8, No. 1, pg. 32.


MAP II-4
YUMA GEOTHERMAL STUDY AREA
Visual Resource Management Classes
VRM CLASS 2
VRM CLASS 3
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
D E S E R T


MAP IX - 5
YUHA GEOTHERMAL STUDY AREA
Scenic Quality Ratings
A - GOOD
B - MEDIUM
C - POOR
Yuha Benches & Bottoms - C
Northern Yuha Desert - C
Yuha Basin - B
West Edge - C
Southern Yuha Desert - C
Signal Mt. Foothills - C
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
D E S E R T

Visual sensitivity analysis results indicate the EAR study area is highly sensitive to visual change due primarily to the region's relatively high recreation visitation and high traffic use volume. In terms of user reaction to visual change, no location was found to rate in the high or moderate category by Sundesert contract socio-economic studies; however, recreational users were not sampled as to their attitudes. While no evidence supports either high or low sensitivity by recreational users of the area, it is reasonable to assume that recreationists have relatively strong feelings about the area. For this reason, the rating employed for this category of visual sensitivity is considered to be moderate.

Management of visual resources is carried out by analyzing the area's scenic quality in combination with its sensitivity. The result of this analysis is the development of Visual Resource Management (VRM) Land classes. Each land class describes a different degree of modification allowed in the basic elements of the landscape (form, line, color, and texture). Classes range from Class I to Class V with Class I being the most restrictive.

VRM land classes established for the EAR study area are Class II for the Yuha Basin region and Class III for the remainder of the area. Management limitations imposed by these land classes are as follows:

Class II. Changes in any of the basic elements caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention.

Class III. Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing characteristic landscape.

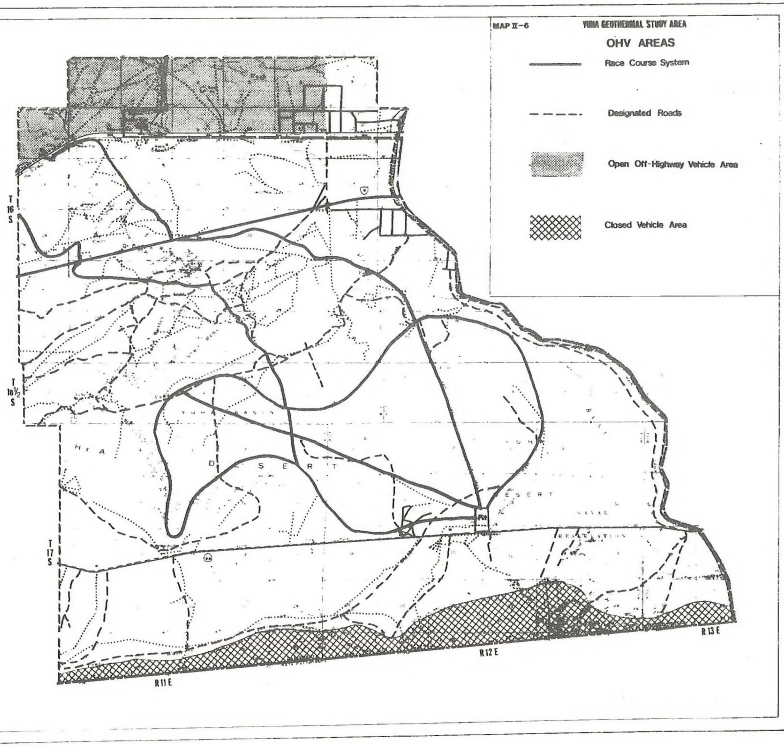
G. Wilderness

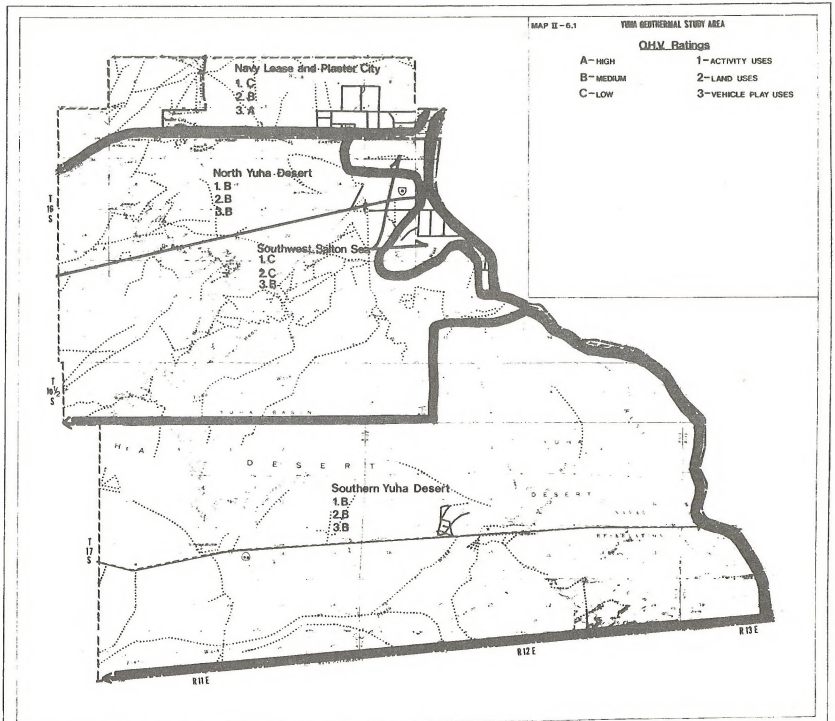
The study area was originally considered to contain potential wilderness values, but subsequent field checks have shown it not to be of sufficient integrity and quality to be included as a wilderness study area. The Yuha URA substantiates this finding as it was determined that the area possesses few opportunities for primitive types of recreational use.

H. Recreation

The EAR study area has had a long and colorful history as a recreation area. Management of recreation in the Yuha region is carried out under two land use plans, the Interim Critical Management Program (ICMP) for recreational vehicle use and the Yuha Management Framework Plan (MFP).

The ICMP was developed to provide emergency protection of the California Desert from the use of off-highway vehicles (OHV). Vehicle use restrictions imposed by the ICMP are shown on Maps II-6 and II-6.1. A second aspect of this plan was the establishment of competitive event areas near Plaster City and the Yuha Basin. Portions of the Plaster City system and all of the Yuha course are located within the study area.


MAP II-6
YUMA GEOTHERMAL STUDY AREA
OHV AREAS
Race Course System
Designated Roads
Open Off-Highway Vehicle Area
Closed Vehicle Area
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
DESERT


MAP II – 6.1 YUHA GEOTHERMAL STUDY AREA
O.H.V. Ratings
A – HIGH
B – MEDIUM
C – LOW
1 – ACTIVITY USES
2 – LAND USES
3 – VEHICLE PLAY USES
Navy Lease and Plaster City
1.C
2.B
3.A
North Yuha Desert
1.B
2.B
3.B
Southwest Salton Sea
1.C
2.C
3.B
Southern Yuha Desert
1.B
2.B
3.B
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
DESERT

The MFP established management priorities for recreation in the area that include protection of scientific study areas and visual resources, and interpretation of natural, historic and archaeological resources. Although this plan has never been fully implemented, the resource values of the region remain relatively intact and decisions concerning them should be considered valid.

1. Competitive Recreation

Competitive recreational use of the EAR area revolves around motorcycle racing events such as scrambles (untimed cross-country races on a marked course) and enduros (timed races on a marked course) with scrambles currently being most common type of event. Other competitive events include four-wheel drive and "Baja-bug" racing and a modified version of softball called over-the-line (OTL).

The EAR area contains the southern portion of the Plaster City sponsor option racing area (including all pit areas), the entire Bureau developed Yuha Basin race course system and two connecting race course corridors.

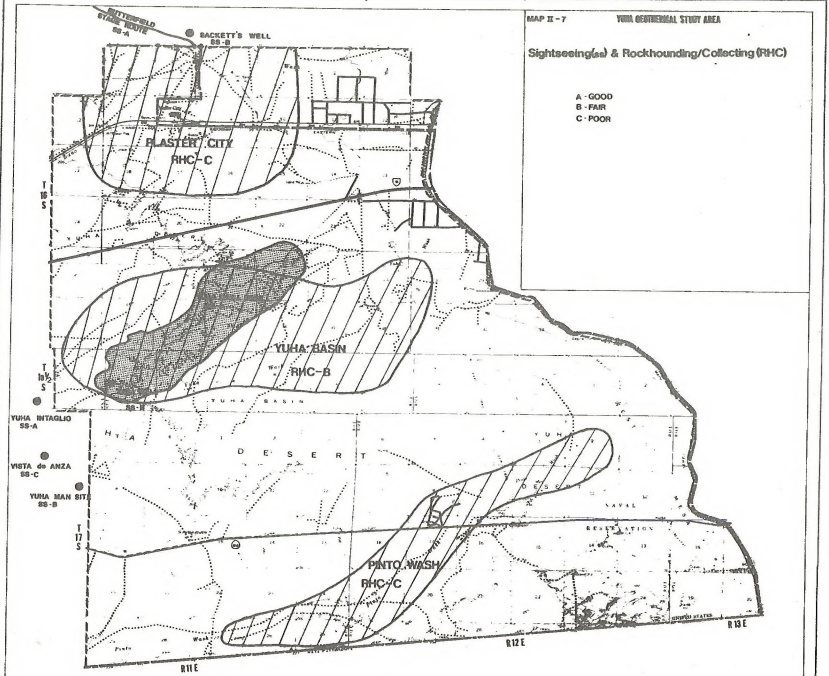
During calender year 1978 these two race areas were utilized for 17 permitted events (13 in Plaster City, 3 in Yuha and 1 in both). While much of the actual racing activity takes place outside the EAR area, nearly all staging and overnight occupancy associated with each race takes place within the study area.

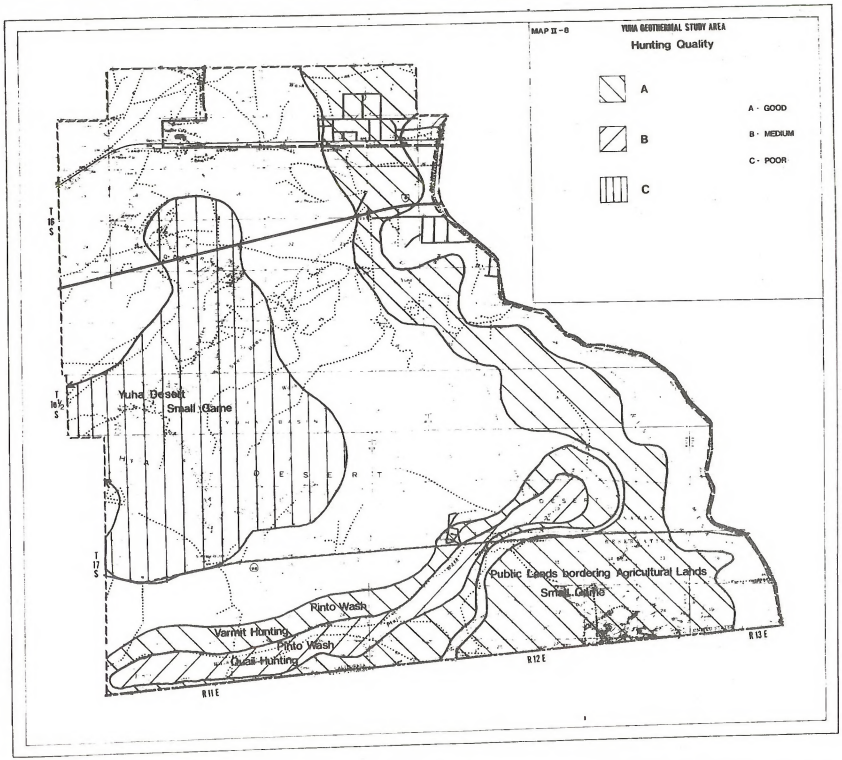
While the sponsor option area is currently more popular with the racing public (13 events to 3), it appears that the Bureau is tending to favor a permanent, well-defined race course system like the Yuha because of environmental concerns related to the consumptive nature of the sport and the increased management responsibility required to evaluate a "new" course for each race. If racing is to continue into the future, more pressure on the Yuha Basin course will result.

2. Non-Competitive Recreation

There are several non-competitive activities associated with the study area. They are presented on Maps II-7 and II-8. Sightseeing is a favorite activity, especially in the spring when the desert flowers are in full bloom. In addition, geologic sites such as the oyster shell beds; historic and archaeological locations like the Yuha Well, the Yuha Intaglio, Vista De Anza, and the Butterfield Stage Route receive use as sightseeing features. The Yuha Intaglio has suffered heavy vandalism and is in need of repair.

Other recreational uses of the area include rockhounding, camping and hunting. Each of these activities is greatly facilitated by numerous miles of OHV travel routes. In most cases, these activities depend upon adequate vehicle access for a successful recreational experience.


MAP II – 7
YUHA GEOTHERMAL STUDY AREA
Sightseeing(SRS) & Rockhounding/Collecting (RHC)
A - GOOD
B - FAIR
C - POOR
BUTTERFIELD STAGE ROUTE
BACKETT'S WELL
SS-B
PLASTER CITY
RHC-C
YUHA BASIN
RHC-B
YUHA INTAGLIO
SS-A
VISTA de ANZA
SS-C
YUHA MAN SITE
SS-B
PINTO WASH
RHC-C
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
DESERT
NAVAL
RESERVATION


MAP II - 8
YUHA GEOTHERMAL STUDY AREA
Hunting Quality
A
B
C
A - GOOD
B - MEDIUM
C - POOR
T 16 S
T 17 S
Yuha Desert
Small Game
Public Lands bordering Agricultural Lands
Small Game
Rinto Wash
Varmit Hunting
Pinto Wash
Quail Hunting
R 11 E
R 12 E
R 13 E

The OHV is also used by BLM in a unique way with educational field trips, or Desert Awareness Events, designed to increase the sensitivity of the recreational vehicle user to the desert environment. A major portion of these trips are held in the study area.

3. Visitor Use

Total visitor use in the study area in 1978 was approximately 216,000 visitor use days (VUD's). Of this total 41,000 VUD's were spent in the area for recreation (as opposed to traveling across the area); 11,300 VUD's were accounted for during competitive OHV events, and an estimated 121,500 VUD's were incidental to visitors traveling across the study area on highways or dirt roads for sightseeing purposes. Refer to Map II-9 for visitor use count polygon areas. Table II-6 presents recreation visitor use by polygon for each sample category.

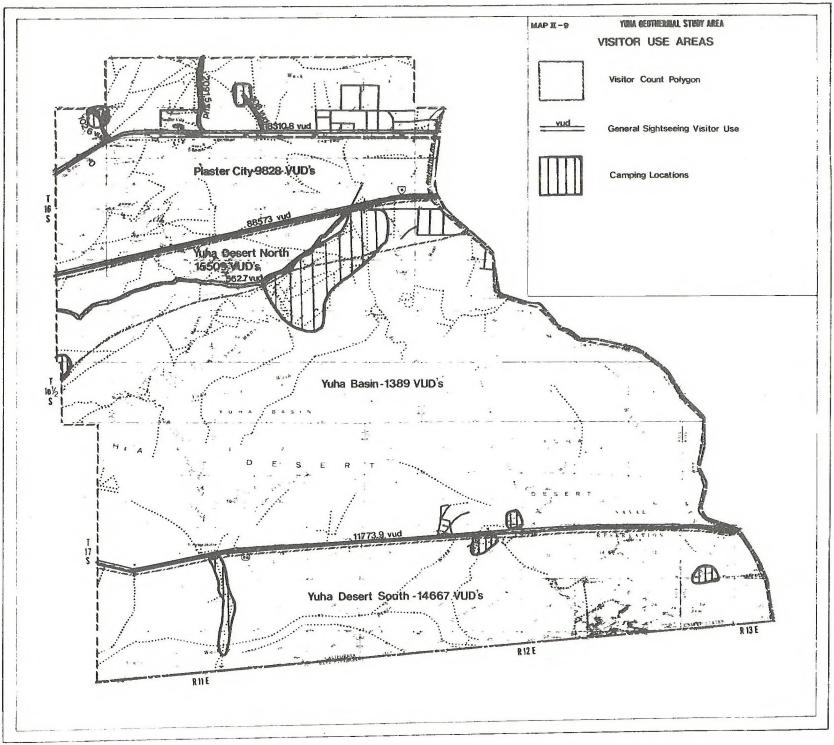
TABLE II-6 VISITOR USE DAYS IN THE YUHA GEOTHERMAL STUDY AREA BY SAMPLE CATEGORY FOR 1978

Polygon	Weekday[1]	Weekend[2]	Holiday[3]	Total
1) Yuha Desert South	0	7,224	7,443	14,667
2) Yuha Basin	0	226	1,163	1,389
3) Yuha Desert North	0	5,870	9,639	15,509
4) Plaster City	872	4,064	4,892	9,828
Total	872	17,384	23,137	41,393

1) Projected total for 249 weekdays
2) Projected total for 43 weekends (86 weekend days)
3) Projected total for 10 holidays (31 holiday weekend days)

I. Socio-Economics

The study area is entirely within the rural and agricultural Imperial County of California. Most of the county's population of 91,800 (State of California, Dept. of Employment Development 1979 estimate) live in and around the six major towns of the Imperial Valley. Estimates provided


MAP II-9
YUMA GEOTHERMAL STUDY AREA
VISITOR USE AREAS
Visitor Count Polygon
vud
General Sightseeing Visitor Use
Camping Locations
Plaster City-9828 VUD's
Yuha Desert North
1650 VUD's
Yuha Basin-1389 VUD's
Yuha Desert South-14667 VUD's
16510.8 vud
88573 vud
11773.9 vud
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E

by the Employment Development Department indicates that 62% of the population is Mexican-American, 3% is of black heritage, and 3% are other non-white. The economy of the County is dependent upon irrigated agriculture, as large parts of the fresh winter vegetables for the United States are grown here. Imperial County is one of the top five agriculturally producing counties in the United States. The major portion of the irrigation and public water supply is imported from the Colorado River through All American Canal System. Imperial Irrigation District is responsible for the operation of the irrigation system and obtains the Colorado River water through an allotment provided by Federal treaty with Mexico, state compacts, and Federal and state agreement.

A survey by Butler and Pick (1977) found that the majority of the population is in favor of geothermal development as long as environmental protection is foremost, although they feel inadequately informed.

The economic, social and political life of the area is strongly influenced by agribusiness and any large scale development could conflict with water allocations and land uses for agriculture, although industrial growth could diversify the economic structure of the county.

A high proportion of employment is in agriculture, and Imperial County has very few people skilled in drilling wells or constructing power plants. Unemployment is usually several points above the state average, partly because of seasonal labor needs. This unemployment pattern is expected to continue.

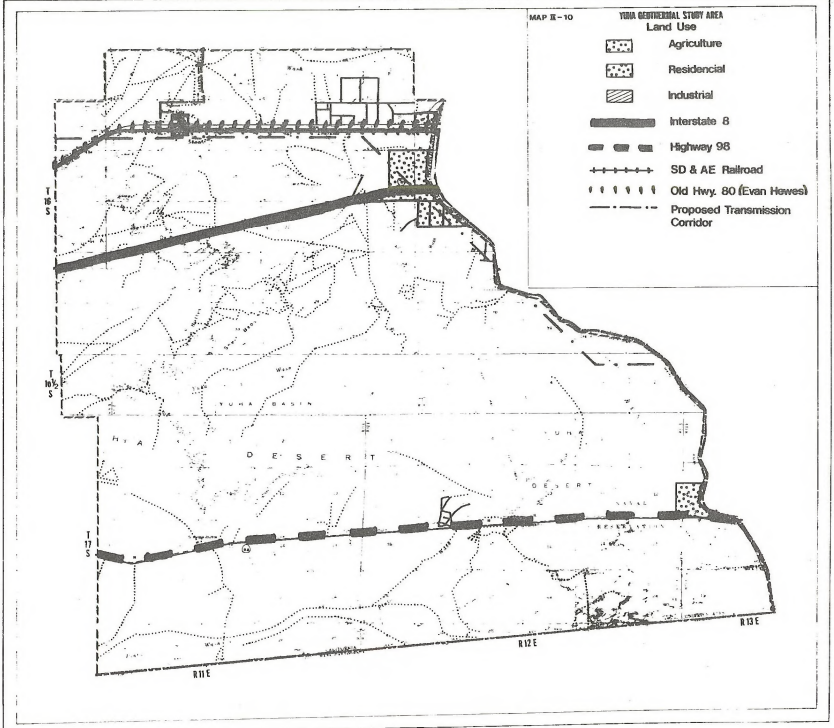
The study area is generally unpopulated except for a small population centered in Section 8 of Township 16 south, Range 11 east (Plaster City) and several country homes just west of the West Highline Canal along Evan Hewes Highway (see Map II-10). There are two small communities to the west of the study area (Coyote Wells and Ocotillo) approximately five (5) miles. All of these communities are located on private land.

The current economic uses of the study area are the plaster product industry (Plaster City-U.S. Gypsum), sand and gravel production, and highway corridors.

J. Land Use

There are two major types of land uses in the study area. One covers large areas for short durations such as recreation, and the other covers limited areas for long periods such as agriculture, industry or roads.

Recreation is the predominant use of the area, with OHV races, camping and sightseeing taking place on cool weekends. Agriculture is limited to private lands located along the eastern boundary of the study area (Map II-10). Industrial development associated with the U.S. Gypsum plant is located along Evan Hewes Highway in the northwest sector of the study area. There are several private residences adjacent to the gypsum plant and some associated with the agricultural development.


MAP II-10
YUMA GEOTHERMAL STUDY AREA
Land Use
Agriculture
Residencial
Industrial
Interstate 8
Highway 98
SD & AE Railroad
Old Hwy. 80 (Evan Howes)
Proposed Transmission Corridor
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
YUMA BASIN
D E S E R T
DESERT

Crossing the study area in an east-west direction is the San Diego and Arizona Eastern Railroad owned by Southern Pacific Railroad. The portion of the track west of Plaster City has been out of service since a tropical storm in 1977 removed portions of the track. That portion of the track east of Plaster City is still used to service U.S. Gypsum. Restoration proposals and negotiations are currently underway to repair the damaged portions of the track west of Plaster City.

There are three east-west highway corridors passing through the study area. They are Interstate 8, and Highway 80 (Evan Hewes) passing through the north half and State Route 98 passing to the south (see Map II-10).

Presently there are no electrical transmission corridors which carry greater than 160 Kv in the study area. However, the Imperial County and State Energy Commission are studying the possibility of establishing an east-west corridor which may pass through or directly adjacent to the study area. A part of this study is considering the San Diego Gas and Electric proposal for a 500 Kv corridor (case file # CA5865) route which crosses the study area just south of U.S. 80. At this time the county has not made a decision as to what route might be used.

Utilization of mineral resources in the study area is limited to sand and gravel production by Caltrans, the Bureau of Reclamation, and Imperial County.

There are no sanitary landfills in the study area. The County is negotiating with BLM for a geothermal waste site to be approximately 14 miles north of the study area and six miles west of Westmorland, California. Until a Class II-1 sanitary landfill is allowed in Imperial County, all geothermal waste will be transported to a Class I waste site in San Diego County.

Land Use Planning for the study area was completed as a part of the Yuha Desert Management Framework Plan (MFP)*. The Yuha MFP prescribes several land management actions within the study area (see Map II-10.1).

Decision #37 of the Yuha MFP prescribes the establishment of a scenic corridor along Interstate 8 to maintain visual aesthetics along this route. The Interstate 8 scenic corridor will assure visual protection of vast expanses of desert badlands, an ancient sea bottom, distant shell beds, and In-Ko-Pah Gorge with its exposed granite batholith and cactus gardens.

Yuha MFP Decision #39, part "b," directs the development of a site interpretive and protection plan for the Yuha Basin: a) Yuha Well; b) Intaglios; c) Vista de Anza; and d) oyster beds. This interpretive plan would identify access, signs, protective devices, etc.

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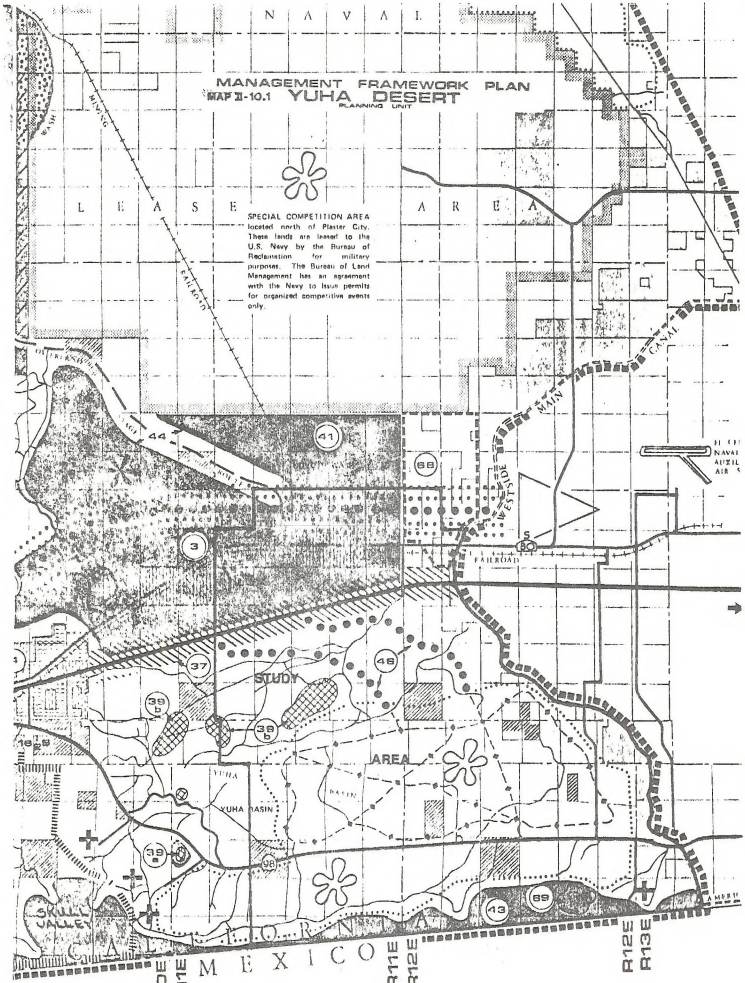
* Copies of the Yuha MFP are available at the El Centro and Riverside BLM offices.


MANAGEMENT FRAMEWORK PLAN
MAP II-10.1
YUHA DESERT
PLANNING UNIT
NAVAL
L E A S E A R E A
SPECIAL COMPETITION AREA
located north of Plaster City. These lands are leased to the U.S. Navy by the Bureau of Reclamation for military purposes. The Bureau of Land Management has an agreement with the Navy to issue permits for organized competitive events only.
MAIN CANAL
EAST SIDE
RAILROAD
STUDY
AREA
YUHA BASIN
SALTON SEA
MEXICO
R10E
R11E
R12E
R13E
35

Decision #43 suggests the closing of an area along the border, between the U.S. and Mexico, to vehicle activity and the discouraging of all forms of recreation and other uses which would interfere with wildlife values.

Decisions #45 and #46 establish courses for the Yuha Basin competitive event area. These courses avoid access to sensitive archaeological sites, rare stands of desert buckwheat, wildlife habitat and areas highly susceptible to erosion.

Decision #69 designates portions of T. 17S., R. 10E., S.B.M., Sections 23 and 24, as the Mt. Signal Research Natural Area and develops appropriate protection, i.e., fencing and controlled access.

K. Noise

Noise is an element of the environment which can be disruptive and high levels can do damage to other environmental communities. Noise can disrupt communication between animals and thus cause physiological changes. Frequencies and sound pressures that do not disturb one animal may disrupt another, depending solely upon the sensitivity of the receptor.

Background noise levels provide comparative data for evaluating the deleterious aspects of noise. While the ambient noise levels of the Yuha Desert area have not been measured, probable levels can be extrapolated from data collected in other desert areas.

The BLM's Desert Planning Staff (DPS) baseline studies (Brattstrom, 1978) measured sound pressure levels (SPL) at various desert sites and elevations for natural and mechanized sound sources (Table II-7). Natural sounds included wind, rain, water, birds, rattlesnakes, and insects. Mechanized sources measured included aircraft, highways, trains, OHVs, transmission lines, power plants and stationary facilities, and impulse sounds such as gunfire or bombs.

From this study, the natural acoustics of the California Desert can be assumed to be of low ambient SPLs, normally not exceeding 66.0 dBA and 70.5 dBL. Over 90% of the measured natural SPLs do not exceed 50.5 dBA and 60.5 dBL.

The sounds of animals usually increase the ambient SPLs of natural environments. However, no desert animal measured produced sounds that exceeded 56 dBA and over 90% of these sounds were below 50.5 dBA and 60.5 dBL, showing that SPLs of natural desert environments are unusually low, with the early morning hours being the quietest.

Mechanized sounds increase the SPLs of natural desert areas in all measured instances, with the increases ranging from 3.0 dBA for transmission lines to over 160 dBA for bomb explosions.

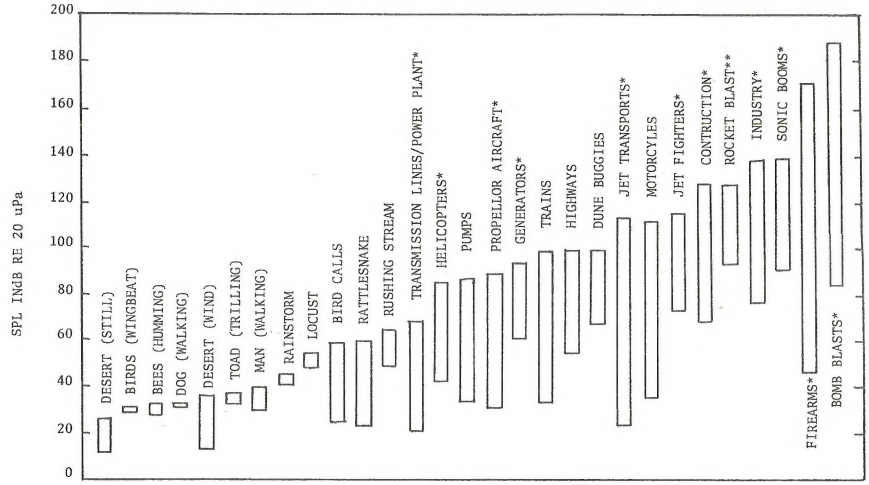


TABLE II-7: RELATIVE SPL'S OF NATURAL AND MECHANIZED SOUND SOURCES OF THE CALIFORNIA DESERT. *UPPER LIMIT FROM PREVIOUS REPORT. **BOTH LIMITS FROM PREVIOUS REPORTS.

Source: Brattstram, B.H. 1978. Ambient sound pressure levels in the California Desert. Report to Bureau of Land Management. Contract CA-060-CT7-2737.

The absence of military bombing or gunnery ranges eliminates the high dBA levels associated with those activities. However, the OHV activities and industrial development bring the ambient noise level above the average 56 dBA baseline measured in the California Desert. It is estimated that the ambient noise level for the study area most probably ranges from a low of 40 dBA to somewhere in excess of 120 dBA, depending on the location of measurement.

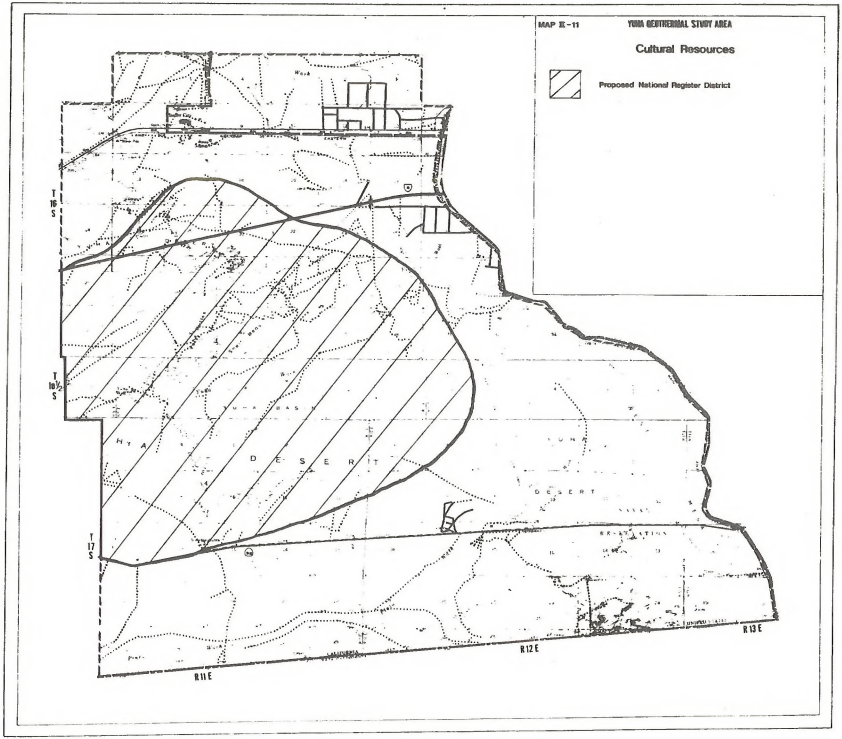
L. Cultural Resources

1. National Register Potential

The project area is recognized as containing a large and complex collection of cultural resources. Human populations, from early man to present day, have used this area, and the result of this activity is a host of archaeological and historical sites representative of changing exploitative patterns and behavior. The analysis of the present data base indicates a very high site density; high site diversity; both inter- and intra-site complexity; and several rare sites. This situation yields a very high potential for scientific study and has elicited many current field research projects from the archaeological community. The potential for public interpretive programs also affords an opportunity for important public awareness efforts. The intensity of the surrounding desert environment is of extreme importance to the understanding of past cultural patterns since it allows for an interdisciplinary approach to the archaeology of the area. Many inroads have been made into the use of such disciplines as geology, hydrology, geomorphology, polynology, soil science, paleontology, etc., for the purpose of eliciting past environments. This is especially important in light of problems encountered with the lack of absolute dating techniques applicable for early culture horizons.

Because of the unique situation in the Yuha Desert and because of the extremely fragile aspect of cultural resources, data from the Imperial Valley College Museum (IVCM) Survey of 1977 was utilized in the proposal that an archaeological district be placed on the National Register of Historic Places. The proposed boundary for this district is delineated on Map II-11. In addition, the Yuha Well area, the Yuha Intaglio and the De Anza Trail, all within the project boundary, have already been determined to be worthy of National Register eligibility by the BLM Yuha Desert MFP. A current survey by Westec Services, Inc., could conceivably identify additional sites or districts worthy of inclusion on the National Register. Such findings will be included in the final draft of this EAR.

Appendix C of this document consists of a synopsis of the cultural resources of the Yuha area that has been abstracted from several pertinent published and unpublished documents. The intent of this narrative is to introduce the reader to the cultural properties. A bibliography of appropriate sources, has been provided to direct further interest in this subject. As a measure against irresponsible loss of archaeological data, information concerning specific site locations has been deleted from this account.


MAP II-11
YUMA GEOTHERMAL STUDY AREA
Cultural Resources
Proposed National Register District
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
H A
D E S E R T
DESERT

Eleven site types are represented in the study area. These indicate varied occupational activities throughout time and space, indicate high site diversity, and high site complexity. The sites are: 1) burial or cremation; 2) cairn or monument; 3) intaglio; 4) isolated find; 5) lithic scatter; 6) pottery scatter; 7) roasting pit or hearth; 8) sleeping circle; 9) temporary camp; 10) trail; and 11) village. Table II-8 represents the number and percentage of each site type that has been formally recorded.

4. Cultural Resource Investigations Previously Conducted

Three types of research have been conducted within the study area. A Class I Inventory was completed in 1974, and consisted of a review and synthesis of all existing data and the identification of all formally recorded sites. Since that time, there have been Class II Inventories--sample survey, and Class III Inventories--intensive survey. Map II-12 gives the areas covered by these inventories. Although, approximately 20% of the project area has been surveyed, a total of 509 sites have been recorded to date.

At the present time, Westec Services, Inc., San Diego, is under contract with BLM to conduct a Class II inventory on a portion of the study area, and the results will provide a better understanding of site density and distribution as well as delineate additional sites or archaeological districts that appear eligible for the National Register. The data will not be available until the final draft of this EAR.

Native American concerns for this area have recently been elicited in two manners. Robert Laidlaw (DPS Ethnographer) has incorporated a contact program involving the entire California Desert Conservation Area. Information gathered in this process will be considered in the formulation of the BLM's desert-wide planning efforts.

In addition to this regionalized approach, project specific input is presently underway for the Class II inventory. The firm conducting this inventory, Westec Service, Inc., has contacted the Diegueno Tribe for input into the nature of the cultural resources present and their concerns for any sacred or ritual areas in the vicinity of the project.

To further the involvement of Native Americans in this project, Westec also had a member of the Sycuan Indian Reservation participate in the early fieldwork stages. All future inventory or mitigation work in connection with this study will involve contacts with the Native American community.

M. Flora and Fauna

1. Important Influences on Habitat

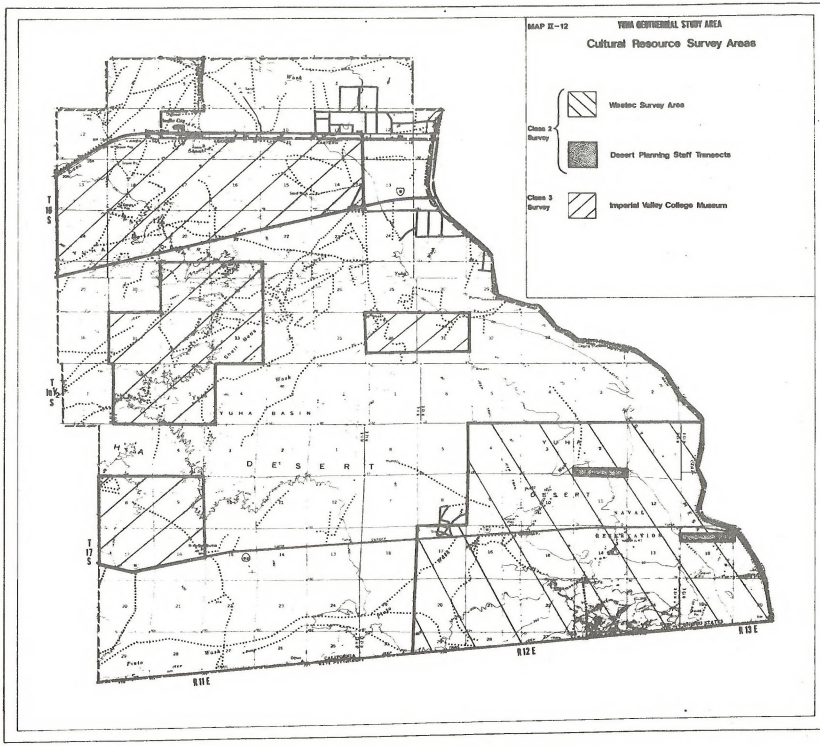
a. Canals

The Westside Main Canal is an important water source for the area. Water escapes through the permeable sides of this and other irrigation

TABLE II-8 YUHA GEOTHERMAL AREA
CULTURAL RESOURCES BY SITE TYPE

SITE TYPE	NO. OF SITES	%
Village	2	.4
Temporary Camp	76	14.9
Milling Station	4	.8
Lithic Scatter	170	33.3
Quarry Site	1	.2
Pottery Locus	16	3.7
Cremation Locus	5	1.0
Intaglio	3	.6
Rock Alignment	2	.4
Trail	26	5.1
Roasting Pit	10	2.0
Isolated Find	151	29.6
Cairn	23	4.5
Historic	7	1.4
Sleeping Circle	8	1.6
Aboriginal Well	1	.2
Not Typed	5	1.0
TOTAL	510	100.7

Compiled by Westec Services, Inc., San Diego


MAP II-12
YUMA GEOTHERMAL STUDY AREA
Cultural Resource Survey Areas
Class 2 Survey
Westec Survey Area
Desert Planning Staff Transects
Class 3 Survey
Imperial Valley College Museum
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
YUMA BASIN
D E S E R T
NAVAL

canals that extend into the study area. This water has allowed for greater cover and abundance of the nearby desert vegetation, promoting mesquite, tamarisk and Mormon tea.

b. Mesquite

Wildlife diversity and abundance in the study area is greatest in the Mesquite Dune Clumps, agricultural habitat type, and in irrigated areas near these canals (see Table II-9). Isolated mesquite hummocks throughout the desert also have a high diversity and abundance of wildlife.

c. Washes

The washes which crisscross the study area are important wildlife habitat. The high water table located in these washes promotes dense vegetation in places and the windblown surface sands provide habitat for specifically adapted plant and animal species.

Flash floods occur periodically in the three washes of the study area, causing a cycle of scouring and regrowth of vegetation. Pinto Wash was especially scoured of vegetation following the hurricanes of 1976 and 1977, and is now undergoing natural revegetation. Many plants living in washes are adapted in some way to this type of disturbance, e.g., requiring seed scarification for germination. Wildlife that left the area when scouring occurred will generally recolonize as vegetation and food increase.

2. Habitat Types Present

For the purposes of this EAR, 12 habitat types are mapped based upon definitions given in the Yuha URA (1974). Habitat boundaries for the URA were mapped to correspond to soil-type boundaries. Field checks conducted for this report indicated that modifications of that map were necessary to conform more closely to the URA habitat type definitions and to provide a useful tool for this EAR. As defined in the Yuha URA, "Ironwood Wash" and "Canals and Irrigated Areas" habitat types also occur in the study area; however, due to their small size in the study area, these have been included in "Smoketree Wash" and "Mesquite Dune Clumps-Agricultural" habitat types.

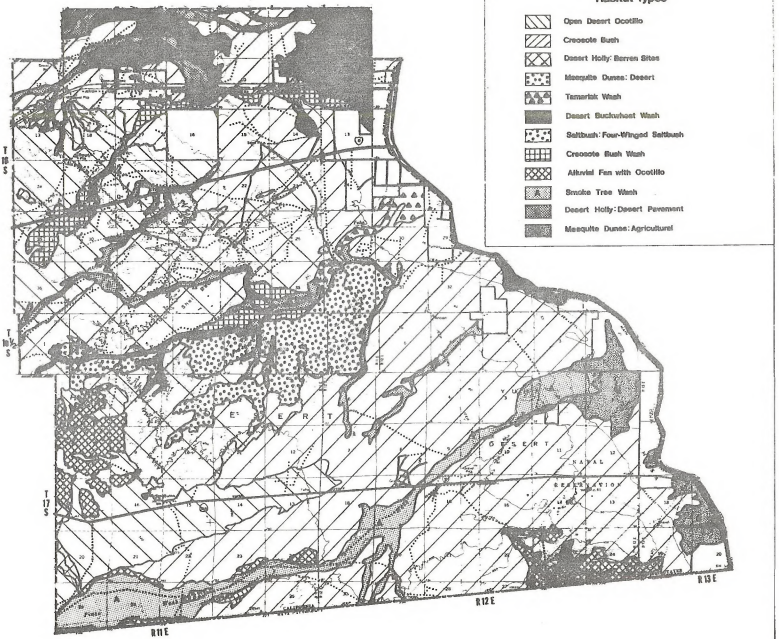
Map II-13 shows the location of each habitat type, and Map II-14 shows the known distribution of each sensitive plant species listed below. Both of the above maps are based upon field studies conducted March through May 1979. Another map will be added to the final draft of this report showing the critical habitat for the flat-tailed horned lizard, if current studies conclude that the lizard be proposed as a threatened species. Table II-10 lists the acreage of each habitat type in the study area, along with the number of species present and the average percent perennial plant cover for each habitat type. A list of plant species as they occur in the various habitat types is given in Appendix "B."

TABLE II-9

Numbers of Wildlife Species Per Habitat Type*

Habitat Type	Amphibians and Reptiles	Birds	Mammals	Total
Mesquite Dunes: Agricultural	28	77	31	136
Mesquite Dunes: Desert	26	41	23	90
Saltbush: Four-winged Saltbush	18	23	18	59
Desert Holly: Barren Sites	13	13	16	42
Desert Holly: Desert Pavement	9	12	15	36
Open Desert with Ocotillo	21	24	21	66
Alluvial Fan with Ocotillo	23	25	18	66
Creosote Bush Community	24	24	20	68
Creosote Bush Wash	22	26	24	72
Smoketree Wash	27	36	25	88
Tamarisk Wash	24	27	21	72
Desert Buckwheat Wash	19	18	17	54

*Includes both observed and hypothetical species; data from Table III-WL-10, Yuha URA.


MAP E-13
YUMA GEOTHERMAL STUDY AREA
Habitat Types
Open Desert Ocotillo
Creosote Bush
Desert Holly: Barren Sites
Mesquite Dunes: Desert
Tamarisk Wash
Desert Buckwheat Wash
Saltbush: Four-Winged Saltbush
Creosote Bush Wash
Alluvial Fan with Ocotillo
Smoke Tree Wash
Desert Holly: Desert Pavement
Mesquite Dunes: Agricultural
T 16 S
T 17 S
R 11 E
R 12 E
R 13 E

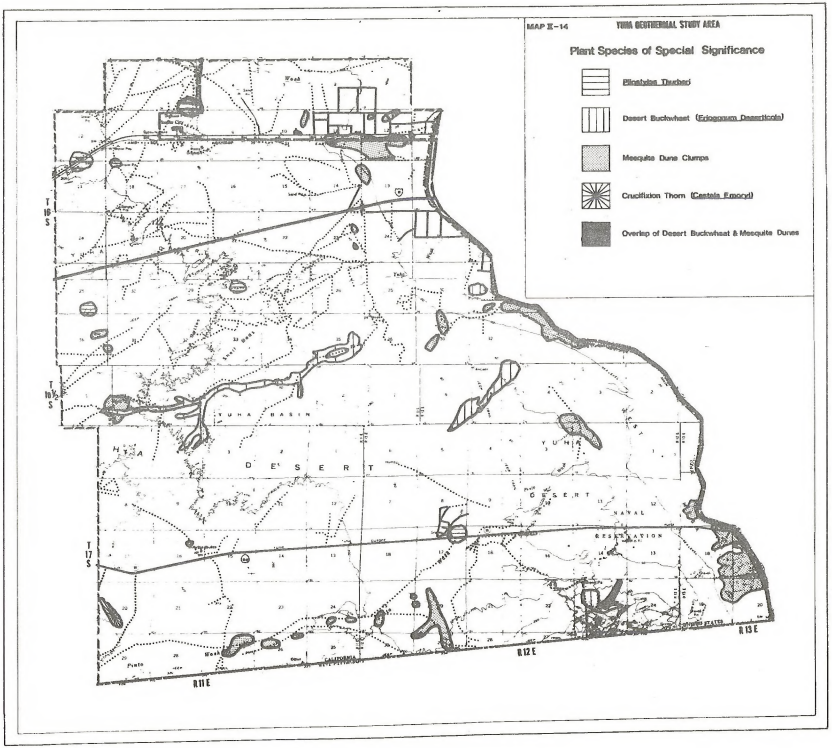

MAP X-14
YUMA GEOTHERMAL STUDY AREA
Plant Species of Special Significance
Pleistylus Tracheli
Desert Buckwheat (Eriogonum Deserticola)
Mesquite Dune Clumps
Crucifixion Thorn (Castela Emoryi)
Overlap of Desert Buckwheat & Mesquite Dunes
T 16 S
T 16½ S
T 17 S
R11E
R12E
R13E
YUMA BASIN
YUMA DESERT
GUNNERY RANGE
NAVAL RESERVATION
MARINE CORPS GUNNERY RANGE

TABLE II-10 HABITAT TYPE AND NUMBER OF PLANT SPECIES

	Acreage	Number of Plant Species	Percent Perennial Plant Cover: Total Range	Percent Perennial Plant Cover: Average
Mesquite Dunes: Agricultural	1,760	33	10-40	20-25
Mesquite Dunes: Desert	208	40	10-20	10-15
Saltbush: Four-winged Saltbush	3,870	26	1-3	1-3
Desert Holly: Barren Sites	10,631	43	0-15	0-2
Desert Holly: Desert Pavement	1,168	11	Less than 1-3	Less than 1-3
Open Desert with Ocotillo	15,588	35	5-50	10-20
Alluvial Fan with Ocotillo	2,928	35	0-15	5-10
Creosote Bush Community	32,894	80	15-40	20-30
Creosote Bush Wash	1,712	57	10-30	15-20
Smoke Tree Wash	6,834	70	0-50	15-25
Tamarisk Wash	1,744	42	5-10	5-10
Desert Buckwheat Wash	384	18	Less than 1-30	10-20

3. Wildlife Species Present

The Yuha URA (1974) tallies of wildlife distribution, abundance and habitat preferences show that 185 species of wildlife occur, or hypothetically occur, in the lease area. A complete listing of species for the Yuha URA is available in the BLM El Centro Resource Area Office and BLM Riverside District Office.

The Mesquite Dune Clumps - Agricultural habitat type has the highest diversity of wildlife species (136) of the study area, but includes only 4 percent of the total acreage. The Saltbush, Open Desert with Ocotillo, and Creosote Bush habitat types cover 84 percent of the study area but only contain between 36 and 72 species (Table II-9).

Species found in the Mesquite Dunes Clumps - Agricultural habitat type include kestrels, marsh hawks, burrowing owls, Gambel's quail, doves, pheasant, Crissal's thrasher, Abert's towhee, kit fox, coyote, striped skunk, raccoon and perhaps Bailey's pocket mouse. Most other desert species inhabitating the study area occur within this type.

The creosote and saltbush communities contain the side-blotched, zebra-tailed, and desert horned lizards, while blow sand areas may have desert iguanas, flat-tailed horned lizard and fringed-toed lizards. Gopher snakes, sidewinders and red racers are common. Resident birds of the creosote community are horned lark, black-throated sparrow, loggerhead shrike, and others, while the saltbush community has less diversity. Small mammals include the Merriam and desert kangaroo rats and the desert pocket mouse. Black-tailed jack rabbits are in creosote communities, washes and mesquite.

4. Wildlife Species of Special Significance

Criteria used for determinng significant species include those used by the State of California and the U.S. Congress for placement on established lists of rare, threatened, or endangered species. Additionally, significant species are those listed on the Audubon Society's blue list, species with limited numbers due to restricted habitat or their position on the food chain, and species having special scientific and educational values.

A summary of wildlife species of special significance is in Table II-11; the flat-tailed horned lizard is the most significant species in the lease area. It has a limited range, some of which is in the lease area, although it occurs in other areas of the south California Desert, including the Algodones Dunes, East Mesa, and Plaster City. This lizard occupies dunes and other areas of windblown sand, feeding mainly on ants. The species has been listed by the U.S. Fish and Wildlife Service for status review and has been fully protected by the State of California since December 1978.

The numbers of the lizard are not thoroughly known, but recent studies indicate that populations in Imperial County are much lower than in the

TABLE II - 11

Wildlife Species of Special Significance
(From Yuha URA)

Species	Significance	Occurrence	Status
Red-spotted Toad *Bufo punctatus*	Restricted Habitat	Smoke Tree Washes	Unknown
Desert Tortoise *Gopherus agassizi*	Protected numbers declining due to habitat loss	Creosote Bush Slumps Mesquite Dune	Probably not present if present most likely released from captivity
Banded Gecko *Coleonyx variegatus*	Protected by bag limit	Creosote Communities, Washes	Common
Desert Iguana *Dipsosaurus dorsalis*	Protected by bag limit	Habitats containing Creosote	Unknown few observations
Chuckwalla *Sauromalus obesus*	Protected by bag limit; restricted habitat; overcollection	Rocky slopes and outcrops	Unknown
Colorado Fringe-toed lizard *Uma notata*	Protected by bag limit; limited and specialized habitat	Wind-blown sands perhaps Pinto Wash	Unknown
Long-nosed Leopard Lizard *Crotaphytus wislezeni*	Protected by bag limits; pets	Widespread	Low number
Desert Horned Lizard *Phrynosoma platyrhinos*	Protected by bag limit; pets	Habitats with creosote saltbush, cactus	Unknown
Flat-tailed Horned Lizard *Phrynasoma m'calli*	Protected by bag limits; specialized habitat	Areas with loose, wind-blown sands; considered scarce to rare	Unknown; may be proposed as a threatened species to U.S. Fish & Wildlife Service

Species	Significance	Occurrence	Status
Common kingsnake *Lampropeltis getulus*	Protected by bag limit; pets	Wide geographic distribution; uncommon to rare in lease area	Unknown; may be two subspecies in or near lease area
Red Diamond Rattlesnake *Crotalus ruber*	Protected by bag limit; prized by collectors	Smoke Tree Wash	Declining due to habitat destruction and senseless killing
Merlin *Falco columbarius*	Diminishing in parts of U.S.	Uncommon transient; observed in Smoke Tree Wash	Unknown
American kestrel *Falco sparverius*	Diminishing in U.S.	Creosote Bush; Mesquite Dunes; Washes	Common to abundant
Red-tailed Hawk *Buteo jamaciensis*	Used by falconers; recreational values	Throughout lease area	Common
Gambel's Quail *Lophertyx gambellii*	Hunted; protected by bay limit	Thickets near water (canals)	Found along canals
Mourning Dove *Zenaida macroura*	Game bird	Along canals; may occur on all other habitats	Common
California yellow-billed Cuckoo *Coccyzus americanus*	Designated rare by CDFG; little habitat remaining in Calif.	Riperaian Habitat; along canals	Unknown
Barn Owl *Tyto alba*	Diminishing in portion of U.S.	Mesquite Dune Clumps; along canals world wide	Unknown
Barrowing Owl *Speotyto cunicularia*	Diminishing in portions of U.S.	Observed on Mesquite Dune Clumps; Canals and irrigated areas	Common in agricultural areas
Anna Hummingbird *Calypte anna*	Little preferred habitat in area	May occur in Smoke Tree Wash	Uncommon
Costa's Hummingbird *Calypte costae*	Exceptionally good populations; provide non-consumptive recreation	Ironwood Wash and Smoke Tree	Population very high
Vermillion Flycatcher *Pyrocephalus rubinus*	Limited available habitat, populations naturally low	Colorado Desert; may occur in Creosote Bush communities	Unknown

Species	Significance	Occurrence	Status
Verdin *Auriparis flaviceps*	Limited in numbers due to restricted habitat	Mesquite; microphyll washes	Uncommon to rare
Bewick wren *Thryomanes bewickii*	Limited numbers due to restricted habitat; diminishing in U.S.	Mesquite - Agricultural	Undetermined
Bendire's Thrasher *Toxostoma bendirei*	Marginal breeding range	Tamarisk and Smoke Tree Wash	Unknown
Crissal Thrasher *Toxostama darsale*	Limited in numbers due to restricted habitat	Mesquite dune clumps, Tamarisk Wash; Canals	Numbers very low
Blue-gray gnat-catcher *Polioptala caerulea*	Restricted habitat, limited numbers	Mesquite dune clumps, Tamarisk Wash	Uncommon
Scott's oriole *Icterus parisorum*	Limited numbers due to restricted habitat	Ocotillo-Alluvial and open desert; canals	Uncommon
Hooded arrole *Icterus cucullatus*	Limited in numbers due to limited habitat	Open desert with Ocotillo	Occasional; frequent in southwestern Imperial County
Abert's Towhee *Pipilo aberti*	Numbers limited due to limited available habitat	Mesquite Dune Clump - agricultural; canals	Frequent to common in agriculture
Desert Song Sparrow *Melospiza melodia*	Numbers limited due to restricted habitat	Mesquite dune clump; belaperone wash; canals	Frequent
Mammals			
Desert Cottontail *Sylvilagus audubonii*	Game animal	Throughout leasing unit in Washes and Thickets	Common
Bailey's pocket Mouse *Perognathus baileyi*	Limited distribution	Probably occur in mesquite areas and Desert Buckwheat Wash	Unknown

Species	Significance	Occurrence	Status
Little Desert pocket mouse *perognathus arenarius*	Limited distribution	Baja California; could occur in Desert Buckwheat Wash and areas of windblown sand	Unknown
Coyote *Canis latrans*	Game animal	Widespread	Common
Kit Fox *Vulpes macrotis*	Fully protected furbearer	Widespread - open, level, sandy; with low desert vegetation - Creosote Bush, Saltbush, Mesquite	Unknown
Raccoon *Procyon lotor*	Open trapping season year-round	Riparian; canals	Unknown
Striped skunk *Mephitis mephitis*	Trapping	Mesquite Dune Clumps canals and irrigated areas	Common
Bobcat *Lynx rufus*	Trapped or taken seasonally, no bag limit	Could occur throughout lease area along washes and canal	Unknown

past (Turner, et. al., 1978). There is concern that the increased use and development of the desert is related to this decrease. The BLM Desert Planning Staff (DPS) is currently studying the distribution and status of the flat-tailed horned lizard, with most of the research being done through a contract agreement with Dr. Fred Turner, UCLA herpetologist. Depending upon the results of the study, a proposal may be made to the U.S. Fish and Wildlife Service for the listing of the lizard as a threatened or endangered species; its "critical habitat" will be delineated in such a proposal. Portions of that habitat may be within the Yuha Geothermal Lease Area, since some of the highest lizard populations occur within the lease area.

Initial evaluations of the flat-tailed horned lizard counts indicate that a relatively high lizard population occurs in the southern half of the Yuha Geothermal Lease Area, while the northern sector has a relatively low population. Prime habitat areas for the lizard occur in eight sections, as determined by high numbers of lizard signs (see Map II-14.1).

Seven of the eight sections are between Mt. Signal and the Sunrise Butte. These sections generally contain creosote bush, burrobush, and Dalea emoryi. The substrate is usually composed of loose sand interspersed with desert pavement and/or sandstone outcrops. The eighth section is located about three (3) miles south of Interstate Highway 8 and one mile west of the West Side Main Canal. The habitat type is generally the same as described above.

Three other areas in Imperial and San Diego Counties have relatively high lizard population. They are: 1) the south end of East Mesa; 2) a thirty (30) square mile area southeast of Superstition Mountain; and 3) a twenty (20) square mile area north of Ocotillo Wells.

The eight prime habitat sections in the study area are:

a. T. 17S., R. 11E., Section 23

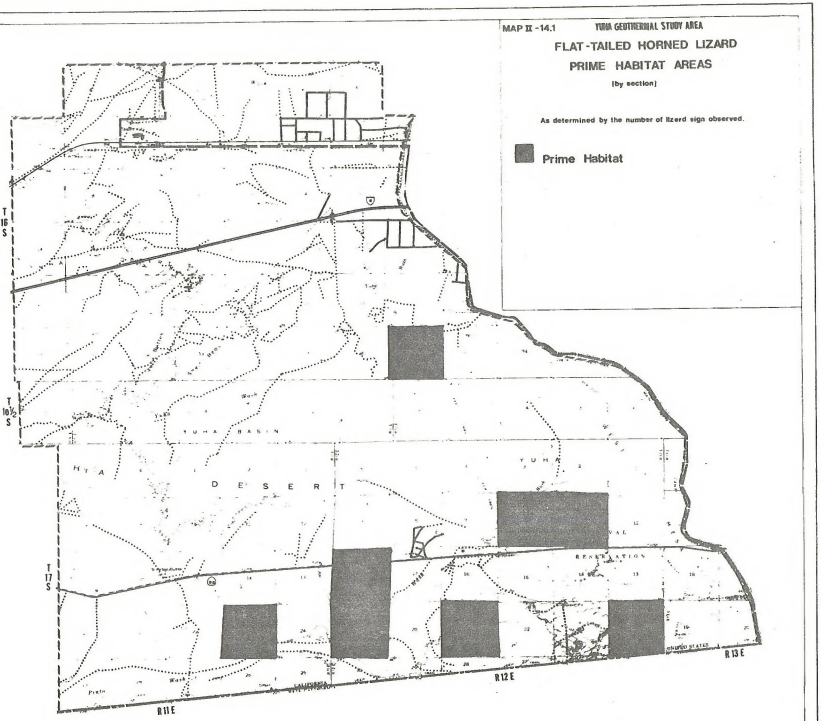
b. T. 17S., R. 12E., Sections 10, 11, 18, 19, 21 and 24

c. T. 16S., R. 12E., Section 31

5. Plant Species of Special Significance

Significant plant species for the study area are those listed in the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants of California (Powell, 1974--Revision 1978, unpublished), and mesquite (Prosopis glandulosa var. torreyana). No plant species in the 1976 or 1978 Federal Register has been found in the study area.

Wildlife diversity is higher in mesquite habitat than in other habitat types of the study area. In the study area, mesquite tends to grow in hummocks which are mounds of sand held together by mesquite roots. These hummocks occur mostly in the two habitat types known as "Mesquite


MAP II - 14.1 YUMA GEOTHERMAL STUDY AREA
FLAT-TAILED HORNED LIZARD
PRIME HABITAT AREAS
(by section)
As determined by the number of lizard sign observed.
Prime Habitat
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
YUMA BASIN
D E S E R T
YUMA
RESERVATION

Dune Clumps--Desert" and "--Agricultural." They are riddled with burrows and provide nesting sites and shelter for many wildlife species. The very high seed-pod production of mesquite provides an excellent protein source for humans as well as wildlife.

The CNPS ranks plants according to their rarity, endangerment, vigor and general distribution (R-E-V-D Codes). Based on these criteria, four categories have been developed for sensitive species (BLM, 1976): Critical, High, Moderate, and Limited distribution.

To reflect current information, R-E-V-D codes used to establish a plant's placement in each category for this study are taken from the 1978 unpublished revised CNPS southern California codes. In the study area, there are no plants in the Highly Sensitive or Limited Distribution categories.

Critically sensitive plants are highly restricted in distribution, and are generally endangered in all or part of their range. The only critically sensitive plant in the study area is Crucifixion Thorn (Castela emoryi) (R-E-V-D; 3-1-1-1). This is a woody, thorny shrub 6 to 12 feet tall and intricately branched. The small leaves drop off during cold or dry periods. Small, greenish-yellow male and female flowers are borne in dense clusters on the same plant during June and July. Clusters of dry nut-like fruits persist on the plants for many years. This plant occurs in dry, gravelly places from the south Mojave and Colorado Deserts to Arizona and Sonora, Mexico. In California, it is found in very few locations.

Moderately sensitive plants are generally confined in distribution but do not appear to be endangered. There are two such plants in the study area. The Desert Buckwheat (Eriogonum deserticola) (R-E-V-D; 1-2-1-2) is an erect perennial shrub that grows about 3 feet tall and is well branched. Leaves are scattered along young branchlets but drop off before flowering time in September to December. Flowers are yellow with green or reddish midribs. Locally common along sandy dunes and washes, it is known in very few locations outside Imperial County.

Pilostyles thurberi (R-E-V-D; 1-1-2-2) is a minute stem parasite primarily found on Dalea emoryi, a common shrub in the study area. Leaves of Pilostyles are reduced to flower bracts and only small brown flowers and bracts approximately ¼ inch long are visible on the host. There are few known locations of this plant. The host Dalea emoryi occurs in eight (8) habitat types within the study area, all of which must be considered as potential habitat for Pilostyles thurberi. Additional study will further define the habitat of this parasite.

III. IMPACTS

Section III of this document will address the impacts associated with each of the geothermal leasing actions discussed in Section I, Part C.

Each specialty section will be separated into three separate units discussing those impacts associated with each alternative action.

Proposed Action #1 represents the most intense of possible impacts on the study area. Thus, the discussions will mostly analyze the impacts of Action #1.

Alternative Action #2 is a result of research team proposals for further mitigations beyond those provided for in the GRO Orders #1 through #7. The impacts associated with Action #2 are closely related to Action #1; however the intensity will be much less.

Alternative Action #3 will result in no impacts upon the existing environment. Action #3 would present no change to existing conditions; however, it would represent an impact upon the geothermal industry and the economic future of Imperial County. This impact is expanded in Part "I" of this section.

A. Geology

Action #1

1. Topographic impacts could occur as a result of the proposed action. Parts of the study area have slopes greater than 10% and are highly susceptible to erosion.

2. Production and injection of fluids from and into the geologic formations could have an effect upon seismic activity, surface subsidence, and surface uplift (VTN Consolidated, Inc., March 1978).

Subsidence resulting from extraction of subsurface fluids would be localized around the well bores or directly above the down-hole fluid extraction points. Mass surface subsidence is considered to be highly improbable.

3. Fluid injection activities could cause an increase in seismic events or possibly preclude the stress releasing minor seismic events and allow pressures to increase thus triggering a large magnitude seismic event (VTN Consolidated, Inc., March 1978). The effects of production and injection activities upon the highly fractured and fluid geologic structure of the Salton Basin is theoretical at best, with several opposed opinions (VTN Consolidated, Inc., March 1978). There is a need to continue to study these activities to assure an understanding of possible impacts.

Action #2

1. The impacts upon geology will be the same as those described under Action #1, for there is no proposed change in production.

Action #3

1. The non-issuance of leases would have no effect upon the geology of the study area.

B. Hydrology

Action #1

1. The Yuha Desert area is a collection point for runoff, and its numerous drainages are hazardous during the rainy season. Construction of well pads, foundations, parking lots, holding ponds and sumps will cause surface changes that will lead to alterations in drainage volumes and patterns, increasing erosion off site. This erosion will also affect the water quality downstream.

2. Fresh water drilling muds commonly used in drilling operations in the Imperial Valley consist of:

Bentonite clay	Bicarbonate of soda
Sepiolite clay	Drilling detergent (diethenolomide)
Lignite	Soda ash
Caustic (sodium hydroxide)	Cotton seed hulls
Cypon (sodium polyocrylate)	Wood fiber

The California Regional Water Quality Control Board--Colorado River Basin indicates that these muds are "nonhazardous" in the concentrations typically used during drilling (Landau 1977); however, after use these muds are stored in sumps and if allowed to mix with geothermal test fluids and dry out, the resultant increase in soils concentrations could cause a change of designation to hazardous materials (Swajian 1977).

3. The potential exists for the co-mingling of groundwaters of the different aquifer zones through seepage around well bores or a breach in the well system (VTN Consolidated, Inc., March 1978). An increase of salt concentrations in the shallow aquifer could adversely affect vegetative growth both natural and agricultural.

4. Throughout the development and production phases of the geothermal industry, a possible high use of water exists. The water supply for the region both surface and subsurface is limited and is artificially supported by water from the Colorado River. An extensive discussion of water availability appears in the VTN EIR for Imperial County on the Heber Geothermal Project.

Action #2

The impacts on hydrology associated with geothermal development will not change substantially with the implementation of Alternative Action #2.

Action #3

There will be no change in the current hydrological environment if Alternative Action #3 is chosen.

C. Soils

Action #1

1. Compaction will impact soils that are a combination of fine and coarse particles more than soils with particles that are similar in size. Wet soils will be more compacted than dry soils, especially with increased vehicle use.

Using the baseline assumption described in Chapter I, Part "D", access roads may cover an estimated sixteen (16) acres, or 0.6% of the baseline lease area (BLA) during the exploration drilling phase. One hundred forty-four (144) acres (5.6% BLA) conceivably could be used for access roads during the plant development phase and would most probably continue in use during plant operation.

Well pads could consume thirty-six (36) acres (1.4% of BLA) during the exploration drilling phase. During development and operation phases the total surface area in use for support of geothermal activities might expand to as much as 180 acres (7.0% of BLA). This involves well pads and plant site.

Those areas of disturbances around the well pads will be less compacted than those areas impacted by access roads. Other areas that may be significantly compacted will be along the pipelines, transmission lines, and near the power plant complex.

Soil compaction can decrease water infiltration and increase the daily soil temperatures. The greatest impact would be the limitation on plant growth that would occur if root systems could not penetrate the soil. Because of this, compaction can intensify drought stress, and BLM studies have indicated that harmful levels of compaction may be achieved with few vehicle passes over wet soil or with a considerably larger number of passes on dry soil.

2. Appendix A estimates of erosion hazard. The only soil shown to have a high erosion factor is in the badlands area. The high rating is given because the soils are generally shallow and located on steep uplands and terrace escarpments.

3. Soils with the highest potential for dust production during construction or from traffic or wind erosion will be those high in silt. Disturbance

of silt will cause greater amounts of dust emission than disturbance of sandier soils or those high in clay. Disturbance of Chuckwalla silt loam and Vint silt loam will result in emission of large amounts of dust. Unpaved access roads will produce dust as long as they are in use, but areas disturbed only during construction will produce dust during a limited interval. Rainfall or the removal of enough fine particles to form a protective layer of coarse surface material will greatly reduce dust.

4. Some of the soils have high inherent fertility. These ratings as well as present land use are shown in Map II-3 and Appendix "A". Most such areas, some of which are private land, are near the Westside Main Canal. Long-term disturbance of these soils can have a negative impact on agriculture in the Imperial Valley; however, only a few acres would be removed from production.

Action #2

With the implementation of Alternative Action #2 the impacts of geothermal development to soils will be similar to those described in Action #1; however, with a reduction of available surface area and a control on development design, the impacts upon soils will be greatly reduced.

Action #3

The no-lease option will have no impact upon the soils of the study area.

D. Climatology

Actions #1, #2, and #3

Geothermal operations are not expected to impact the climatological environment of the study area.

E. Air Quality

Action #1

1. Impacts to air quality are expected to be minimal during the exploratory phase.

2. During the field development stage impacts to air quality will occur because of exhaust emissions from diesel and gasoline equipment, emissions from wells, and dust from ground breaking activities. Emissions from diesel and gasoline equipment could combine with oxidants increasing the local NO_2 levels.

Earth disturbing operations, such as those required for construction and maintenance of access roads, may increase the incidence of Valley Fever among workers during the hot dry months. This disease is caused by Coccidioidis immitis, a fungus normally found in the soil. The fungus produces large quantities of infectious anthrospores while growing in the soil. These are readily disseminated by air currents and in dust when the soil is disturbed.

The seriousness of the disease ranges from sub-clinical infection with antibody formation, through pulminary coccidio idomycosis with its flu-like symptoms, to the disseminated form with a mortality rate of approximately 50%. The coccidioidomycosis mortality rate for all of California is approximately 25 persons per year. Most infections occur in the Bakersfield area.

3. During the production and operation stage there may be increased levels of non-condensable gases such as CO_2, H_2S, NH_3, H_2, CH_4, and N_2.

Without a data breakdown of the content of non-condensable gases in the suspected resource, it is impossible to preduct whether or not standards of air emission levels will be exceeded.

4. The closedown phase is expected to produce impacts similar to, but less than the field development stage.

Action #2

The impacts would be most probably the same as those described in Action #1. Alternative Action #2 proposes no change in the size or quantity of geothermal power plants, therefore, no change in air emission levels.

Action #3

The dis-allowment of geothermal development will not affect the current air environment.

F. Visual Resources

Action #1

Potential visual contrasts have been projected from seven Key Observation Points (KOP) located near or in the study area. Each was selected on the basis of its location, sensitivity or public use.

Because of the general nature of the proposed action, potential visual contrasts produced by geothermal development will vary depending on the location of the resource. For the purpose of this evaluation, the most likely locations for development as identified by previous exploration, will be used as contrast analysis focal points. These locations are the Yuha Buttes-Oyster Shell Beds and the Mount Signal areas. All KOPs will be discussed in relation to these two areas.

1. Yuha Buttes--Oyster Shell Beds

From KOPs 1, 2, 6 and 7 insignificant to week visual contrasts are anticipated for all stages of development. At each KOP, views into this area are either partially or totally shielded by intervening landforms or vegetation. Also, common viewing angles from these points are extremely acute so that most ground level, low profile developmentsor surface modifications are hidden from view. High profile projects such as transmission lines and cooling towers and their stream plumes may be seen; however, the area's rolling landscape and lower evaluations reduce the chances of these intrusions being seen at full height or silhouetted against the skyline. Also, probable viewing distances to potential development locations in this area are no closer than four miles. In concert, topography, viewing angle and distance act to effectively reduce potential visual contrasts from KOPs located along the major transportation routes crossing the project area.

KOPs 3, 4 and 5 are anticipated to receive low to moderate contrasts from the proposed project. While their viewing distance is similar to the other points, their superior positions afford a more direct view of the development.

Low profile developments such as pipelines, roads and drill pads will produce varying contrasts levels depending on their proximity to the KOPs. Contrasts will take the form of vegetative line and texture, land form, color, line and form modification, and structural line. If development is relegated to the Buttes, each low profile contrast should be absorbed into the landscape because vegetation is sparse and the badlands formation, with its numerous sandy washes, offers a variety of opportunities to shield or otherwise reduce visual instrusions.

The intricacy of the badlands is less pronounced west of the Buttes, however. This allows details to stand out because viewing distances are shorter. All things being equal, development west of the Yuha Buttes--Oyster Beds would result in higher level contrasts. High profile projects including the power plant, will create greater contrasts as the capacity of the basin region to absorb vertical development is limited. While the skylining of these structures is unlikely, large blocky structures will be readily visible if located to the west of the Buttes.

In all cases, steam plumes created by cooling towers will contrast with the tans, reds and browns of the basin's soils.

2. Mount Signal

From preliminary reports, the most likely area for development in the Mount Signal area is just north of the mountain. This area is not readily visible from KOPs 4, 5, 6 and 7. Contrasts created at these points appear to be insignificant.

Critical observation points are located along Hwy. 98 with KOPs 1 and 2 being most important. Both of these are situated within two miles of the geothermal area, and they offer inferior viewing positions of Mt. Signal.

From KOP 1, only high profile developments would be seen as relatively dense creosote bush vegetation lines the highway and most of the anticipated development area is located to the south and west of the Lake Cahuilla shoreline. At KOP 1, the shoreline rises approximately 15 feet above the level of the road and cuts off the view of the mountain's lower slopes. Also, the Mexicali-Tijuana aqueduct and associated pumphouse and powerline are clearly visible from this location. Additional structures are not expected to produce significant impacts.

KOP 2 is similar to KOP 1 except that it is located atop the Lake Cahuilla shoreline. All existing structures are in plain view as are the lower slopes of Mount Signal. Both high and low profile projects would be seen from this point. Anticipated contrasts would fall in the moderate range as orientation of the KOP would permit skylining as well as views

of low level structures. Contrasts here would revolve around structural form and line, land feature form, line and texture and possible vegetative texture changes.

KOP 3 is located approximately nine miles away from the geothermal anomaly near Mount Signal, and permits views of the base of the mountain. It also allows superior views of the surrounding creosote bush plains to the northwest. Possible contrasts from the proposed project appear to center on structural form and line as well as vegetative line and texture. Low profile development would significantly alter the existing patterns found in the region seen from KOP 3. Depending on the location of the proposed developments, contrasts will be low to low/moderate.

Action #2

1. The impacts associated with Alternative Action #2 with respect to visual resources could possibly have a deleterious effect if the location of a plant site is placed on a high point within the study area. Such a situation might come about if it is found that other resources would be greatly affected by the placement of a plant site in a low level concealment land form.

2. Visual resources will be weighed equally with the other resources and all will be required to minimize use. In such a system, impacts to visual resources will be minimized.

Action #3

Alternative Action #3 will not impact visual resources.

G. Wilderness

Actions #1, #2, and #3

Since no region within the study area has been found to contain minimum wilderness characteristics as defined by the Wilderness Act of 1964, no impacts to wilderness values will occur as a result of the implementation of the proposed action or the alternatives.

H. Recreation

Action #1

1. Impacts of the preliminary exploration stage will be minimal to low in intensity for all aspects of recreation as surface disturbance, public access restrictions and other conflicting uses will be held to a minimum. In locations where existing roads will be improved it is anticipated that public access for recreation will be enhanced.

2. Exploration drilling will result in low to moderate impacts to recreation primarily through the development of new roads and test drilling pads. While these access routes will enhance OHV play by

providing a greater diversity of opportunities, unauthorized vehicular play in previously undisturbed regions may occur as camping and staging areas are moved closer to prospective recreation locations. Sightseeing, including botanical, archaeological and geological activities, along with rockhounding, could be beneficially impacted because of better access in remote areas. This is especially true for visitors who do not have off-highway vehicles. Rock material will be exposed through road cutting and pad construction, aiding collection.

3. Field development will have a moderate to high effect on most recreational uses of the Yuha area, the most notable affecting the Yuha Competitive Race Course System.

The Yuha Race Course, race corridors and pit areas lie entirely within the study area. Unlike the Plaster City Sponsor Option System, the Yuha course cannot be altered without a large commitment of work months to complete the extensive archaeological and biological surveys required to "clear" a new route. As the field is developed, roads and pipelines will cut across the course, conceivably in many locations. While the number of races held on the course is considerably less than the Plaster City area, future demands for BLM race systems will put these courses at a premium as "suitable" areas are rare and their development for competitive racing is extremely controversial.

4. Additional impacts to competitive racing would be the hazards created by non-race related use on roads and trails constructed for this stage. Currently, signs, barricades or check points are required where race vehicles cross public roads. By increasing the number of roads in the area, the potential for race course/public road intersection accidents would be increased. Added restrictions and liabilities imposed on race clubs or promoters could have a profound effect on the success of future authorized racing activity.

5. Moderate impacts will occur to all forms of sightseeing recreation. While GRO orders require protection of unique geologic, cultural and historic sites, sightseeing values must also be managed within the context of the region.

6. Construction and ancillary noise and dust from the construction operation will detract from the natural character of the region. At the least, sightseers will be distracted; at the worst, the area's sightseeing values will be negated. This is especially true for botanic areas, historic trails and as yet undiscovered burial and intaglio sites.

7. Field development will impact other recreation uses as well. Rockhounders should find conditions improved as road building and earth movement will uncover new collectible specimens; however, rockhounders, along with ORV enthusiasts, may experience a loss of access to favorite areas as new roads and pipelines may cut across existing accesses.

8. Hunters using locations adjacent to agricultural lands should not be affected by this development stage as most, if not all, activity will

take place to the west within the Yuha Basin or to the south near Mt. Signal. Small game hunters will find a general reduction in success as habitat conditions near Pinto Wash and the Yuha Basin are disturbed by construction.

9. Desert awareness groups would find this stage disturbing as well as educationally exciting. While some natural desert values are sure to be impacted, a greater emphasis can be placed on uses and needs for desert resources.

10. No changes are envisioned for transient users except that access from the main highway to sightseeing areas may be restricted. Other forms of visitor use should decrease as a result of interference with OHV access.

11. Impacts resulting from the production/operation stage will be similar to those of the field development stage for competitive OHV uses. However, general impacts to activity oriented recreation would be less severe as users would now be confronted with a relatively static level of geothermal development rather than a rapidly expanding one. As time progressed, additional roads and trails will evolve as ORV users will attempt to circumvent access closures created during the field development stage. Eventually, these routes will become permanent landmarks.

12. Sightseers and hunters would be more severely impacted as the values these visitors seek would be disturbed by the previous development stage. Rockhounders will find a lower quality experience as their access is reduced and collecting areas uncovered by field development are picked over.

13. It would be reasonable to assume that visitor use will rise slightly as vehicular recreation reaches an equilibrium with field expansion. Use levels should not reach pre-field development figures, however, as access and freedom of movement for users would be restricted by the now established geothermal field.

14. The closedown stage would result in an overall reduction of impacts. Areas previously blocked by roads and pipelines would be cleared and available for managed public access. Popular camping areas presently limited to the periphery of the Yuha Basin would be expanded by taking advantage of the numerous miles of graded road constructed as part of the geothermal operation.

15. Sightseeing conditions would be improved as rehabilitative landscaping would once again put cultural and historic sightseeing locations back into a favorable frame of reference. As disturbances are reduced, seasonal wildflower displays should return. Geologic sightseeing on the other hand, will experience continued degradation as the oyster shell beds, desert pavement and badlands formations of the Yuha Basin are difficult to reconstruct or rehabilitate.

16. Visitation, while difficult to estimate precisely, would be expected to increase as previous use patterns oriented around vehicular recreation would return. All factors being equal, visitation should approach current levels. Gas shortages, changes in recreation habits of the desert user and the success of the California Desert Plan will all have an effect on future participation rates.

Action #2

1. The impacts associated with Geothermal development upon recreation will be very much the same as those described under Action #1 impacts. However the reduction of surface disturbances and the limitation of surface access to specific recreation areas will further reduce the impact of geothermal development on the recreation activities in the Yuha basin.

Action #3

1. No impacts are indicated.

I. Socio-Economics

1. The proposed action is consistent with the prevailing public sentiment on geothermal development in Imperial County, but there is a potential conflict between agricultural and geothermal interests. Water availability is the key but the potential for conflict is no greater in the study area than in any of the other geothermal sites in the County.

2. Transmission line routes will also cause problems between the two interests, but in all, development in the study area would probably be less disruptive to public attitudes than would equivalent development at these other sites because it is currently outside of the developed agricultural area. The threshold for conflict is five years after the first plant begins operation, and at that time the County (as directed by the County geothermal element) would have to decide whether to permit agricultural water to be diverted for geothermal uses in this area.

3. Property tax revenues for a 50 MW plant would be approximately $250,000 per year based on an assumption of $5,000 in taxes for each megawatt (Imperial County Geothermal Element). Tax revenues prior to development of the power plant would be negligible. Likewise, additional costs to public agencies to provide service to people employed by the project would be negligible. Employment impacts have been based on the environmental impact report for the proposed Heber Geothermal Demonstration Project (VTN, 1978).

4. Table III-1 shows employment associated with the development model. Due to the specialized nature of the work, most of the employment would go to people outside the County, thereby not reducing the County's unemployment. Since as much as 75% of the employees prior to the production and operation stage would come from outside the County, they would constitute an increase in demand for motels and rental housing, but this

Table III -1

Employment For Model Lease

Stage	Number of Employees	Duration
Preliminary Exploration	6-10	6 months
Exploration Drilling	20	1 year
Field Development		
Well Drilling and Pipeline Construction	105	1 year
Plant Construction	110	1½ years
Electrical Transmission Line	20	3 months
Production and Operation	25	N/A

increase would not be noticeable except during the winter harvest season when temporary quarters are hard to find. The effect would be to make a minor contribution to higher rental and motel rates in the nearby communities.

Action #2

1. The impacts of geothermal development, as described by Action #2, on the socio-economic environment are considered to be the same as described by Action #1 because there will be no change in the size and quantity of development.

Action #3

1. A decision not to lease the Yuha Basin for geothermal development could have a deleterious effect upon the economics of the Imperial County. With a reduction in the area available for development of geothermal energy there will be a measurable decrease in the economic potential and diversity of the currently agriculturally dependent economy.

2. Action #3 would have an effect upon the future job market by reducing the number of full and part-time positions available in the geothermal industry.

3. The alleviation of geothermal development from the Yuha Basin would reduce the public tax dollar available for the support of public facilities such as: schools, fire and police protection, water and sewer, electricity, etc.

J. Land Use

Action #1

1. Proposed Action #1 is a major deviation from the historic and current land uses as described in the current environment section of this document. The two primary uses of the Yuha Basin to date have been recreation and, to a much smaller extent, agriculture. The impacts on recreation have been described in part "H" of this section.

2. As described in the current environment section, the Imperial County general plan land use element and geothermal element do not recognize the study area as having potential for geothermal resource development. Without this formal recognition established the County is not able to approve any permanent geothermal land action in the study area. The County can permit exploration for geothermal resources in any area of the county without a formal designation of a geothermal resource area; however, no additional approvals may be given without such a designation.

3. Decision #37 of the Yuha MFP could be invalidated if the resource is found within the proposed corridor and development is permitted.

4. Decision #39, part "b", #43, and #69 will most probably not be impacted by this proposal.

5. Decisions #48 and #46 may be impacted by geothermal development if construction limits the competitive event trails area, thus eliminating some interest in the use of that area for competitive OHV events.

6. In the late 50's through the mid 60's, land reclamation activities for agricultural production expanded into the eastern edge of the study area. At this time expansion of the agricultural valley has been curtailed due to the lack of additional water allocations from the Colorado River. As shown in the Soils section, there is additional fertile soil area capable of agricultural production within the study area. Thus, the dedication of this land area to geothermal development, a long-term land use, could alleviate the future use of this area for agricultural production.

Action #2

1. The application of Action #2 to the study area would provide for a greater diversity in land use types, thus providing for the multi-use format of development prescribed by BLM policy.

Action #3

1. No impacts are offered.

K. Noise

Action #1

Several geothermal activities produce noise levels that can be deleterious to surrounding environs. Tables III-2, III-3, and III-4 present noise levels that can be expected during geothermal exploration and development operation in the project area.

Noise levels during the exploration and construction stages are short lived and at times, highly intense, possibly reaching levels of 100 dBA or higher.

Noise levels during plant operation, production well flowing, and injection well pumping will all be long term impacts which will have some effect upon the wildlife appearing in the area. Discussion of the impact of noise levels on wildlife appear in the flora and fauna sections of this document (Chapters II, III, IV part M).

1. Residential receptors are located along the periphery of the study area, thus could be affected by high noise levels if geothermal activities occur within 500 feet of residential locations (VTN Heber EIR March 1978).

2. Although well venting is the loudest noise source associated with geothermal operations, its frequency is such that distance and obstacles easily attenuate it.

TABLE III-2

CONSTRUCTION EQUIPMENT
NOISE RANGES

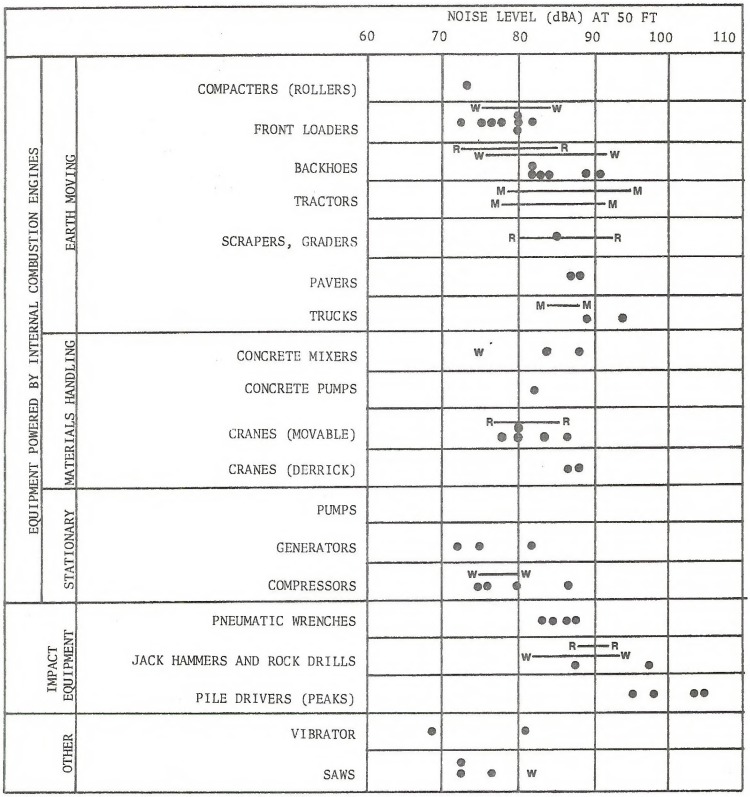


TABLE III - 3

GEOTHERMAL POWER PLANT
OPERATIONAL NOISE LEVELS

Source	Distance	Sound Level (dBA)
Reinjection and production pumps(1)	5 feet	86-90
Condensate pump(2)	3 feet	81
Purge pump(2)	3 feet	88
Cooling water pump(2)	3 feet	77
Cooling tower(3)	5 feet	85
Turbine/generator(3)	3 feet	94
Switchyard(4)	200 feet	55
Transmission line(5)	50 feet	50

Sources:

(1) Chevron Resources Company, 1977.

(2) VTN and SDG&E measurements 7/21/77, geothermal test plant, Niland, California.

(3) Pacific Gas & Electric Company, 1976.

(4) Southern Engineering Company, 1975.

(5) Bonneville Power Administration, 1977.

TABLE III - 4

PREDICTED NOISE IMPACT
CONCEPTUAL FIELD DEVELOPMENT OF A GEOTHERMAL ANOMALY

		Predicted Noise Level Ranges (dBA)			
		Distance From Source			
Activity	Source/Distance	500'	1000'	1/2 mile	1 mile
Construction	85-90/50 feet	65-75	59-69	51-61	45-55
Drilling	66-71/200 feet	58-61	52-55	44-49	38-43
Plant Operation					
power plant	60/500 feet	60	54	46	40
pumping island	86-90/500 feet	46-50	40-44	32-36	26-30

Source: VTN Calculations 1977

3. Cooling tower noise is a source with more potential for impact beyond the project boundaries because its frequency distribution makes it more difficult to attenuate (Lawrence Livermore Laboratory).

Action #2

1. The noise impacts of geothermal development would be closely related to Action #1.

Action #3

1. No impacts from geothermal activity noise would exist.

L. Cultural Resources

The majority of known cultural resources in the Yuha Desert are surface manifestations. Consequently, the archaeological record in the study area, after more than a century of Euro-American occupation, is extremely fragile and nonrenewable. The opening of the Yuha Desert to geothermal development would impact cultural resources in two ways:

1. Direct impacts by exploration and development will result in surface disturbances.

2. Opening new areas for public access will create indirect impacts, such as OHV disturbance and unauthorized collections that have the potential of becoming more serious and long range.

See 36 CFR 800 for more information on adverse impacts from surface disturbance.

Action #1

1. Preliminary Exploration

Cultural resources that are present in construction areas will be altered or destroyed. Succeeding stages will have increasing impacts, depending on site location, size, and density.

Activities during this stage will alter the surface and produce either indirect or direct impacts. Easier accessibility will increase worker/visitor use of the area. The major effect of these unregulated activities will be the partial or complete development will determine the impact to cultural values.

2. Exploration

The impacts discussed for Phase I can be anticipated in this phase also; the difference will be in the degree of surface disturbance and increased access.

3. Field Development

This stage will have the greatest potential for impacts to cultural resources since it involves the largest amount of surface disturbance. Complete avoidance of destruction or alteration of cultural resources is unlikely. The impacts discussed above apply here as well. Additionally secondary visual, audible, and atmospheric elements (see 36 CFR 800) that are out of character with the cultural values would be introduced during this stage.

4. Production and Operation

No additional impacts are anticipated during this stage unless new wells or a waste disposal site are developed. Such impacts will produce the same results as above.

5. Closedown

No additional impacts are anticipated during this stage.

Action #2

1. Geothermal leasing under proposed Action #2 will not allow surface disturbance of identified valuable cultural resources, thus reducing the impacts described in Action #1.

2. Impacts to cultural resources as described in Action #1 will still exist but to a lesser extent.

Action #3

1. There will be no impacts to cultural resources due to geothermal development.

M. Flora and Fauna

Action #1

Major impacts to vegetation and wildlife will occur during all phases of development and will include: 1) vegetation and habitat loss due to surface disturbance and pollution; 2) disruption of wildlife behavior and possible physiological changes caused by noise and human activities; 3) crushing of wildlife and vegetation by vehicles or other accidental

injuries and deaths; 4) possible lowering of the water table because of shallow aquifer well water use, influencing plant and indirectly animal survival; and 5) changes in drainage patterns caused by possible subsidence and site flood and erosion-protection measures.

Impacts during preliminary exploration will be low because smaller machinery will be used in localized areas that are accessible by existing roads. Through the remaining development and production stages, impacts will increase as surface disturbance, pollution potential, and noise levels increase. Closedown will benefit the area because structures and equipment will be removed and rehabilitation efforts will be initiated.

As development progresses and the intensity of the impacts increase, efforts to rehabilitate impacted areas to pre-development conditions will have less chance of success. Loss of native vegetation and topsoil may be permanent due to low moisture and fragile soils. Natural revegetation success often depends on the degree of soil alteration, the extent of vegetation destruction, the extent of exotic plant introduction, the degree of aridity of the disturbed area, and climatic factors (BLM 1974, BLM 1976, BLM 1977, Vasek et al 1975 a & b, Gillette et al 1974). Displaced wildlife may not return. Exotic plants which invade disturbed areas may permanently establish themselves, making pre-development rehabilitation impossible.

The character and quantity of the plant community are major factors in determining wildlife composition, abundance and diversity. The loss of vegetation and wildlife habitat will reduce the long-term productivity of the area, resulting in a decline in populations and a change in diversity, decreasing the stability of the biota in the area (BLM 1977).

Habitat loss will have the greatest impact in areas of high wildlife use, especially mesquite hummocks and densely vegetated washes. The lowest impact will occur in barren and desert pavement washes. Impacts to wildlife in Creosote Bush Communities having sandy areas and large ant populations could be high due to loss of habitat if the flat-tailed horned lizard occurs there.

1. Construction Activities

The most severe impact of construction roads, drill sites, pipelines, power plants and transmission lines is the loss of vegetation and hence the loss of wildlife habitat. The primary causes of vegetation loss include: 1) surface disturbance; 2) crushing and uprooting by machinery; and 3) soil compaction.

Construction would also result in the loss of wildlife by crushing animals and their burrows or by displacement due to noise, harassment, and surface occupancy.

Roads represent a cumulative impact. Even though existing roads will be used where possible, major improvements to existing roads or new roads will be needed for full field development.

New roads facilitate the invasion of exotic species which may affect the health and vigor of native plants and animals (Johnson, et al 1975). New roads facilitate the use of new areas by ORVs, which can have great indirect impacts on these areas (BLM 1977). Roads can also increase erosion by channeling runoff away from established washes, thereby reducing existing vegetation, hence wildlife habitat.

Roads can have a positive effect on vegetation. Studies in the Mojave Desert have shown that areas adjacent to paved and unpaved roads tend to have more shrub biomass and annual plant diversity (Johnson et al 1975). Apparently this is due to relatively mesic conditions at the edge of the roadway. The proliferation of annuals was found to completely change the vegetative makeup of the area. The effects of such habitat alteration are difficult to predict, but may be extensive.

Soil compaction and surface disturbance represent serious long lasting impacts on the environment (Vollmer et.al. 1976, BLM 1978, Stebbins 1974). Soil provides physical support, water and mineral nutrients for plants growing in it as well as habitat for burrowing animals. Surface disturbance generally increases erosion of the soil layer, and disturbs soil horizons. Compaction produces an increase in soil bulk density and a loss of soil pore spaces which may reduce or eliminate penetration of water and roots and alter the soil temperature regime (Snyder et.al. 1976, Stebbins 1974). Seedbeds and root systems can be destroyed by the increased density of soil, lack of air and water, and increased rate of temperature fluctuation in compacted soil. All of these factors may make it difficult or impossible for animals to construct and live in burrows in compacted soils.

Chances of vegetation recovery in compacted areas are poor. The greater the degree of soil compaction, the longer the time period required for habitat recovery. Depending upon the combination of variables in each case, natural revegetation in a desert climate may occur as quickly as 30-40 years in areas of high productivity (Vasek et.al. 1975a) to essentially never in highly disturbed, low productivity areas. The Yuha area must be considered of fairly low productivity.

Wildlife may be lost to transmission lines through collision and electrocution. Pipelines resting on the ground could reduce the mobility of small animals, affecting foraging, reproduction and social behavior. These pipelines could also alter the drainage pattern by diverting normal water flow, changing the vegetative composition of washes and adjacent areas.

2. ORV Use

ORV impacts have been documented and referenced in the North Salton Sea Geothermal EAR--Final (BLM, 1979). In summary, studies show that ORV

use reduces shrub density, canopy cover, and diversity; reduces the diversity of annual and perennial herbaceous species; reduces the germination of wildflowers and increases the density of weedy species; compacts the soil; and creates new noise levels and other human disturbances affecting wildlife.

These factors affect the amount and kind of vegetation available to wildlife for forage, nesting and other activities.

New roads may increase public access and thereby increase ORV impacts, because much of the study area is well suited for off highway travel. Until trail designations are observed and enforced, adverse impacts to biota will be moderate to severe. Such impacts would occur to mesquite hummocks when used for hill climbing, and in washes when used for cross-country travel.

3. Noise

Noise will impact wildlife during all development and production stages. Several authorities (Romney, 1976; Miller as cited by Stebbins, 1974; Bondello, 1976) have documented noise impacts on reptiles, birds and mammals. Noise has limited the hearing ability of desert iguanas; hearing loss in the Mohave fringe-toed lizard occurred after exposure to dune buggy sounds of 95 dBA and 100 dBA (Brattstrom and Bondello, 1979). Operation, construction and associated noise levels of 100 dBA or greater could cause hearing loss in similar species, such as the Colorado fringe-toed lizard.

The operation of power plant and related facilities produce sound levels which approach 100 dBA noise levels at distances between 3 to 50 feet (Table III-3). This represents a long term impact, for these noise levels are above the estimated ambient noise levels of the desert. Smaller animals seem more susceptible to noise and unable to adjust. Larger animals tend to become habituated to higher noise levels although they may also suffer hearing loss (Woodward - Clyde, 1978) (Brattstrom and Bondello, 1979).

Noise can disrupt social and reproductive functions of birds that rely on auditory signals. It may alter predator-prey relations to one or the other's disadvantage. The greatest impact would occur during spring and early summer and in areas of high wildlife densities.

4. Pollution

Pollution of air, soil, and water can occur from sump failure, well testing, well casing leaks, spillage (of gas, oil, and detergents), and acid washes. The degree of impact depends on the location, amount, type, and concentration of the pollutant, and drainage patterns, type of habitat, season of the year, and climatic factors associated with pollutant release. The most sensitive season is spring and early summer when new plant growth and most wildlife reproduction efforts are taking place.

Spillage of liquid wastes could accelerate soil erosion and reduce productivity or actually sterilize the soil. If toxic wastes are discharged into a natural drainage, periodic flash flooding could transport those wastes over a very large area, thereby affecting plant and animal population composition and density, especially in the washes.

Gases and vapors which may be released include carbon dioxide, carbon monoxide, nitrogen, ammonia, hydrogen, boron, and hydrogen sulfide. Some of these chemicals have been shown to have the potential to cause severe impacts of long duration (USDI, FWS 1976). They could modify the nutrient cycle and destroy wildlife habitat, usually in a localized area near the pollution source.

5. Wildlife Species of Special Significance

The flat-tailed horned lizard will be studied intensively during the spring and summer of 1979 by BLM. With that information, BLM may propose to the U.S. Fish and Wildlife Service that the lizard be listed as a threatened species. The lizard's critical habitat would be delineated at that time.

Impacts to this species will occur with the loss of important habitat features consisting of creosote bush combined with sparse to barren areas having loose sand. Lizards may be lost through construction and ORV activities as the number of roads and vehicles increase. Impacts could be very important because the study area contains some of the best remaining habitat for the flat-tailed horned lizard.

The Colorado fringe-toed lizard (Uma notata) occurs in specialized habitat consisting of sparse vegetation and windblown sand. If these areas are lost to surface occupancy or heavy ORV traffic, impacts on the local populations could be high due to loss of specialized habitat and crushed animals. Impacts to the species could be low to moderate because of the loss of specialized habitat in the Plaster City area and Lower Borrego Valley (BLM 1974).

The little desert pocket mouse (Perognathus arenarius) may occur in the area's Desert Buckwheat Washes and habitats containing windblown sand. This species has not been collected in the study area, however, it is usually found in Baja, California near the U.S. and Mexico boundaries. Loss of these specialized habitats could have an impact on this species in the United States.

The kit fox (Vulpes macrotis) is a fully protected furbearer in California that probably occurs throughout the study area. It has been found in Creosote Bush Wash, Creosote Bush Communities, Mesquite Woodland and Salt Bush. Surface disturbance in these areas may destroy kit fox dens, significantly impacting this animal.

5. Plant Species of Special Significance

The four plant species of special significance will receive the same type of impacts already discussed for vegetation. Surface disturbance in areas inhabited by these plants will probably remove existing plants and may destroy the habitat necessary for their reestablishment due to soil disturbance, pollution effects, and/or increased competition with other plants. All four of these species grow in drainages, so that any pollution accidents "upstream" from these plants may adversely affect them due to transport of the pollutant by periodic flash floods.

As discussed in Chapter II, Crucifixion Thorn (Castela emoryi) fits the BLM definition of a critically sensitive plant. A very small population is located in the study area. Any disturbance of this population may probably lower the chances of survival of this species in California, thus any impacts to this species would be high.

Desert Buckwheat (Eriogonum deserticola) is a moderately sensitive plant. The most extensive populations in the study area occur in Yuha Wash, where the population is both dense and young. Plants in wash environments tend to be disturbance-adapted. This factor, combined with the extent of the Yuha Wash populations, suggests that some amount of development in carefully-placed locations could occur in the three Buckwheat areas near Yuha Wash with low impacts on the species.

The Buckwheat population near Mt. Signal is fairly dense, but localized. It may be a distinct breeding unit from the Yuha Wash populations and appears to be at the southern extent of this species' range (Westec, 1977). Because of these factors, impacts to the Mt. Signal population will probably be high; any impacts which destroy this population may result in a reduction in the range of this species. A significant reduction in range may impair the species' ability to recover from natural as well as man-caused catastrophes, and may cause the endangerment rating for this species to be upgraded from moderately to highly sensitive.

Pilostyles thurberi is also moderately sensitive. Field studies conducted for this report discovered three previously unknown locations for Pilostyles. Since its principal host, Dalea emoryi, occurs throughout the study area, and since its small size makes Pilostyles difficult to locate, further studies are needed to determine its exact range in the study area. It seems to grow on few Daleas in scattered locations, so that removal of any Daleas infested with Pilostyles may have a high impact on the parasite. There is little information available about the habits of this parasite.

Impacts to mesquite hummocks would also impact wildlife. Impacts upon mesquite as a species will be very low.

Action #2

1. Through an identification of and the limiting of surface occupancy in sensitive flora and fauna resource sites the impacts described in Action #1 upon these fragile resources will be greatly reduced.

Action #3

1. No impacts are foreseen.

IV. MITIGATION MEASURES

Chapter IV of this document is intended to address those mitigation measures which should be applied to the lease contract to lessen or eliminate the impacts described in Chapter III. It is the intention of BLM that this document chapter be the basic reference for the design and development of surface protection features within the described study area.

The following statement will be attached to all geothermal leases let by BLM on lands covered by this EAR:

> "Prior to the development of a plan of operation (43 CFR 3203.6 30 CFR 270.34) the lessee shall contact the area geothermal supervisor office, USGS, Menlo Park, and authorized officers of BLM and Imperial County to review local and state regulations, the geothermal Resources Operational Orders 1 - 7 (USDI, USGS, 1976) and those special stipulations provided for in the EAR on Yuha Basin/Mt. Signal non-competitive leases for geothermal exploration/development."

GRO Orders 1 - 7 address general and specific environmental protection measures to be applied to geothermal exploration and development on federally controlled lands. However, the GRO Orders tend to be somewhat confusing, because many of the provisions are general in nature. The GRO Orders have been reviewed and are not repeated here for they are part of the proposed action. The following mitigation measures have been developed by the EAR study team as additional mitigation measures not addressed by the GROs and are proposed for the full protection of the delicate environs found in the Yuha/Mt. Signal study area.

The application of the following mitigation measures will be provided for in two (2) phases. Some of the mitigation measures discussed in the following paragraphs are specific to the overall study area and should be applied as lease stipulations. Others of the following proposed mitigation measures are specific to a possible site location within the study area boundary and should be considered as mitigation on each of the plans of operation as it occurs. A designation within parentheses located at the end of each individual proposed mitigation will indicate whether the proposed mitigation is to be applied as a lease stipulation (LS) or a plan of operation mitigation (POM).

Mitigation Proposed Action #1

A. Geology

1. Topography

Considering the fragile condition of some soils and the appearance of slopes of 10% and greater in the central study area, it may be necessary to limit the size, access, and location of development. BLM shall field check each proposed development site for soil condition and stability, and determine the suitability of the site for use. (POM)

2. Subsidence and Seismicity

Injection of spent geothermal fluids from production facilities on Federal leases is a standard requirement. Theoretically injection should alleviate any unnatural subsidence or seismic activity caused by withdrawal of fluids from the subsurface.

GRO Order #4 covers subsidence and seismicity in great detail. However, the installation of seismic monitoring instrumentation is optional, and is only required after a tectonic event has taken place.

Therefore, the field developer should be required to provide for an attachment to and participate in the local survey network of benchmarks, tiltmeters, and extensor meters to monitor and objectively separate geothermally induced tectonic occurrences from regional historic subsidence, uplift and horizontal movements. (LS)

If through this monitoring it is determined that development is the primary contributor to an observed increase in tectonic activities that are harmful to the environment, then action should be taken to correct the situation. These actions could include the following:

(1) A change could be made in production quantities or pressure.

(2) A change could be made in injection quantities or pressure.

(3) A shutdown of operations.

B. Hydrology

1. The California Regional Water Quality Control Board--Colorado River Basin will have jurisdiction over the geothermal development characteristics that might affect water resources. Through application procedures set by the state board, discharge requirements and monitoring and reporting programs will be established. This will be based upon process criteria, working program goals, and state and federal regulations, thus no additional mitigation is necessary.

C. Soils

1. Vehicular activity on areas other than permanent access roads must be avoided when soils are wet to prevent severe compaction of soils. (POM)

2. No road or site construction will block the natural drainage patterns. Suitable crossings will be installed on drainages, sites and roads drained or bermed as necessary to control erosion, and closely simulate the natural drainage patterns. (POM)

3. As directed by the AGS, downspouts will be provided where culvert drains might cause fill cutting and accelerated erosion. (POM)

4. Cut banks and fill areas will be sloped so as to prevent slope failure and minimize erosion.

5. All proposed new roads planned for permanent or long-duration use will be adequately gravelled or paved to control erosion and all roads not deemed necessary for further use will be barricaded, scarified, and revegetated. (LS)

6. Sites of surface disturbance will be sprinkled with uncontaminated water to minimize wind erosion of soil, prevent contamination of soils, and lessen the possibility of Valley Fever infection. The lessee will comply with state water quality standards in determining water use. (LS)

7. All rehabilitation measures will be designed to restore the area to as near a natural condition as possible. The topsoil on all disturbed areas will be stockpiled for use in reclaiming sites and compacted areas will be scarified. Under no circumstances will the soil be turned over. (POM)

8. All power transmission lines will be located and constructed in a manner consistent with the Imperial County's general plan transmission corridor element (currently under study). (LS)

9. Maintenance of all roads constructed or improved as a result of geothermal development shall be the responsibility of the lessee or a designated representative of the lessee. A BLM surface protection specialist will determine necessary maintenance through unscheduled maintenance inspections. (LS)

D. Climatology and E. Air Quality

1. If quantities of H_2S are found in the geothermal resource the effect of H_2S emissions on ambient air quality will be quantified through an air quality and meteorological monitoring system to be established and operated by the lessee. Daily records will be kept by the lessee. Monthly reviews should be made by the Office of the Area Geothermal Supervisor, USGS, Menlo Park, California. Appropriate mitigation measures will be developed by USGS and implemented by the lessee to assure that the H_2S emissions do not exceed those levels established by the County's Air Pollution Control Board. (POM)

2. Construction crews working in the area must be informed by the lessee of the possibility of infection by Valley Fever from disturbance of desert soils. They will also be informed of the symptoms of Valley Fever and referred to physicians who have experience in treating the disease. (LS)

F. Visual Resources

1. When technically and environmentally feasible developments such as roads, trails, and transmission lines will be kept in the Yuha Basin in order to lower the relative height and reduce viewing angles. (POM)

2. Transmission towers will be painted dull gray or left as galvanized metal and use specular insulators. (LS)

3. Architectural and landscaping design techniques should camouflage as much as possible the plant and well sites to reduce contrasts from KOPs. (POM)

4. The scenic corridor along Interstate 8 (Yuha MFP Decision #37) should not be intruded upon by geothermal development. (LS)

5. All roads and pipelines intersecting Highway 98 will intersect at a 90° angle and then curve into the desired direction, shortening the viewing time and shielding the development. This action will require that the BLM Area Office surface protection specialist determine location and length of all roads and pipelines intersecting Highway 98 through onsite visual inspection. (LS)

G. Wilderness

Since no wilderness values exist in the study area, no mitigating measures are proposed.

H. Recreation

1. All roads and trails in the study area designated by the Yuha MFP will be provided with pipeline crossing to allow for recreational travel. To reduce impacts to the Yuha race course and the visual impacts of overhead pipeline crossovers all pipelines will be buried (when feasible) at each location to a depth of three feet (3') where they intersect the race course, roads and trails. (LS)

2. Roads constructed in support of geothermal activities that cross the Yuha race course will be graded to approximate the grade of the course. These intersections will be held to a minimum, as determined by a BLM surface protection specialist.

I. Socio-Economics

1. The impacts associated with geothermal development projected to accrue to the local economic environs are generally seen to be positive in nature and require no mitigation.

2. To prevent the short term need for housing due to large work forces during construction and development activities the lessee should be made aware of the need for temporary housing for the transient work force. (LS)

3. The lessee should be made aware of the water use conflict between the geothermal activities and the agricultural activities. To date the County geothermal element provides for the use of agricultural irrigation water during exploration and up to 5 years of power generation demonstration for each KGRA. However this is conditioned on the developer researching

and developing an alternative source of water supply other than the agricultural irrigation water. The lessee should also be made aware of the current status of use of water from the Ocotillo/Coyote water basin adjacent to the study area. (POM)

J. Land Use

1. Before development of the projected geothermal resources in the study area, there is a need to resolve the conflicts between land use allocation on federal lands and Imperial County's general plan land use designation for the study area. There are two methods by which this conflict can be resolved:

a. Direct the lessee to submit applications to the Imperial County Planning Director to change the geothermal element of the County's general plan to reflect the possible existence of geothermal resources within the study area and designate the study area as an area of geothermal development potential, thus providing for land development activities related to geothermal development. (POM)

b. Direct the lessee to submit data, required by the Area Geothermal Supervisor, USGS, that would provide the USGS the information necessary to designate the Yuha study area a Known Geothermal Resource Area (KGRA), thus providing for the development of this area for geothermal resources under the existing geothermal element of Imperial County. (POM)

K. Noise

1. All well drilling and construction equipment will be muffled in conformance with the Imperial County Geothermal Element of the General Plan. (LS)

2. While deliveries of supplies and equipment by heavy trucks cannot be limited to daylight hours only, such deliveries should be made during daylight hours to reduce the frequency of nighttime noise disturbance. Studies have shown that the nighttime hours are particularly noise sensitive and high noise levels will travel greater distances than during daylight hours. Thus, by eliminating nighttime high noise levels, less sensitive receptors will be impacted. (POM)

3. When technically and economically feasible, the stacking and making up of drill line during drilling operations should be done during daylight hours or, if such activities become a problem, construction of an acoustical baffle may be necessary to reduce noise level.

4. GRO Orders #4 - 11 provide for the monitoring of geothermal development and operational noise sources. However, prior to any exploration, development, or operational activities taking place within the study area, an ambient noise level must be established. Without an ambient noise level, no comparisons can be made to determine what noise attenuation measure must be taken to minimize the impacts of geothermal activities

upon wildlife and human habitats. Therefore, BLM should perform an ambient noise level study for the study area. (LS)

5. As demonstrated in Chapter III, cooling tower noise is a noise source with a high potential for long term impacts to the local environ beyond the plant site boundaries, because the frequency distribution is over such a vast range it is difficult to attentuate through mechanical design (page 72).

Thus, duirng the plant site selection and design process, a primary criteria of review shall be to provide for the maximum possible separation between the noise source and the sensitive receptor locations.

A second criteria should use landscaping techniques and natural land forms to form noise attenuation baffles. (LS)

L. Cultural Resources

1. The BLM recognizes its legal obligation that all Bureau projects and Bureau-assisted or licensed projects (1) give adequate consideration to cultural resources and (2) do not inadvertently harm or destroy these resources. In order to address the question of mitigation, it must first be known what cultural properties will be impacted, either directly or indirectly, by the proposed undertaking.

Because only portions of the project area have been intensively studied and inventoried for cultural resources, the lessee will engage a qualified professional archaeologist, acceptable to BLM, to conduct a thorough and completed intensive inventory (Class III) of areas to be disturbed in a manner acceptable to BLM. (LS)

2. When technically possible the lessee will avoid cultural properties by shifting development sites to areas away from cultural sites, at distances to be determined by cooperative agreement between the State Historic Preservation Officer (SHPO) and BLM. (POM)

3. When it is determined by the area geothermal supervisor that the movement of a proposed development site would deleteriously affect the production of operation of the geothermal resource, the lessee shall remove as much archaeological data as possible from the site utilizing a research design to be outlined by the BLM and SHPO. (POM)

M. Flora and Fauna

1. The base line noise level in the areas of operation will be established by the lessee before operations may proceed. These noise levels will be used by the Authorized Officer to reference acceptable levels of noise in the operation areas during the February to June breeding season of sensitive small reptiles and birds known to be present in the lease area. Refer to Map II-13 for areas of greatest concern. (LS)

2. Protective barriers will be built around sumps to prevent wildlife from entering. (POM)

3. Transmission lines will be constructed following design criteria suggested by the Raptor Research Foundation (1975) to reduce losses of raptors by electrocution. (LS)

4. Pipelines will be raised at least one foot off the ground to allow greater mobility of small animals. (LS)

5. Groundwater levels will be monitored by the lessee when well water is being used so that consumption levels can be adjusted accordingly to preserve vegetative growth. (POM)

6. Site locations for surface disturbance activities will be surveyed by a qualified biologist for all sensitive flora and fauna species, to standards set by BLM. Cost of these surveys shall be borne by the lessee.

If any sensitive species are located, actions will be taken to assure the protection of that species. (POM)

N. Mitigation Alternative Action #2

Alternative Action #2 suggests that portions of the leasing area will be restricted from surface occupancy by geothermal development. The research which is discussed in this document has shown the study area to have high values for several of the resource areas (archeology--flora and fauna--recreation, etc.). If the proposed action is taken, then the total lease area becomes subject to surface disturbances which may adversely affect some of the high value resource locations. Thus, it is suggested that in addition to the existing GRO Order and the previously prescribed mitigation measures, one more step be taken which will assure that those resource areas of most value will be protected from surface disturbances.

Techniques of site selection developed by Ian Mcharg could be used to specifically map the various location of surface resources. A map would be compiled of the location for each specific resource. These locations would be evaluated as to their sensitivity to disturbances and given a designated shading.

1. Highly sensitive (black)
2. Sensitive (gray)
3. Not sensitive (clear)

Each of the specific resource maps are then overlaid on each other and those areas of non-sensitivity will appear as clear and all of the sensitive or highly sensitive areas will appear as various shades of gray to black.

Those areas which appear as non-sensitive would be leased with provisions for surface occupancy allowed as designated by the GRO Orders and those mitigation measures discussed in the proposed action.

Those areas which are designated as sensitive (grays) would be considered for surface occupancy only when the lessee can demonstrate a need for access which would benefit the development of the geothermal resource. Those areas would initially not be leased with any provisions for occupancy described; however, the lessee could petition the BLM for surface occupancy rights for specific site development and it will be the lessee's responsibility to provide the BLM with all necessary information demonstrating the need for entry. The BLM will study these requests and apply appropriate mitigation to those approved.

Those areas given a highly sensitive designation would not be considered for surface occupancy leasing. Access to subsurface geothermal resources would be from adjacent lands.

In all three instances, the lessee would be required to minimize surface disturbance by using geothermal development techniques which would be least consumptive of surface area.

Maps IV-2 through IV-7 present the findings of the EA team. These maps have been created by the above expressed process and further refined to reflect legal survey boundaries which most closely describe an actual resource location.

Map IV-2 presents the overall outcome of the overlay system. It has been titled "Lease Types" for ease in understanding what process will be used to provide for protection. Type I lease areas represent areas where only one resource is present. Type II lease areas represent areas where two resources are present. Type III lease areas indicate the presence of three or more valuable resources. Type IV lease areas are ones where highly sensitive and valuable resources are present and it is suggested these areas are those locations within the study area where no surface occupancy should be allowed. Type V lease areas are those areas where no sensitive surface resources were found.

Maps IV-3 through IV-7 show breakdowns of each of the lease types and what resources are present.

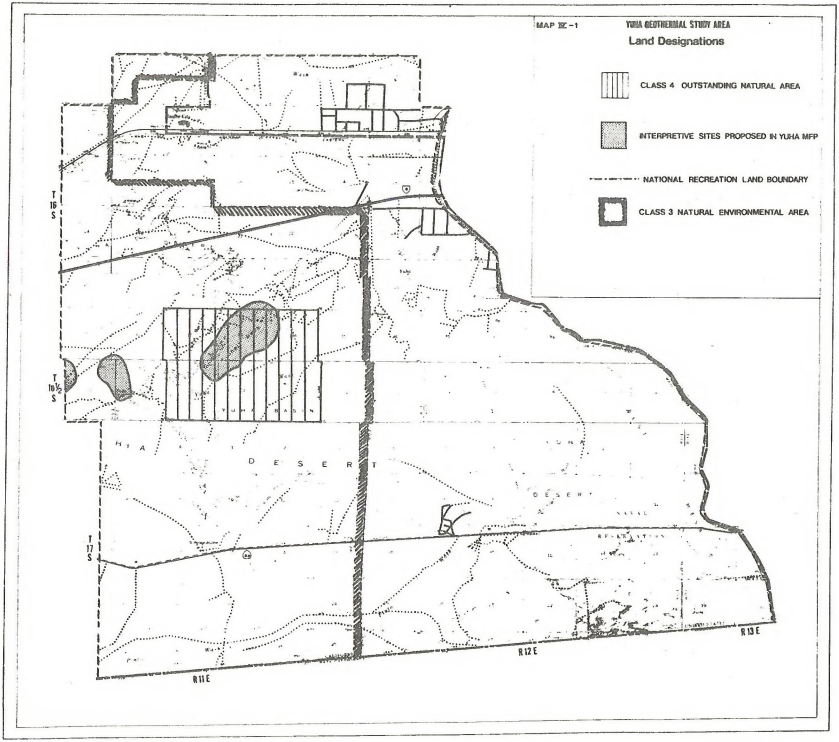
All mitigation proposals presented for the proposed Action #1 will apply to this Action #2. In addition, the following mitigation measure should be applied.

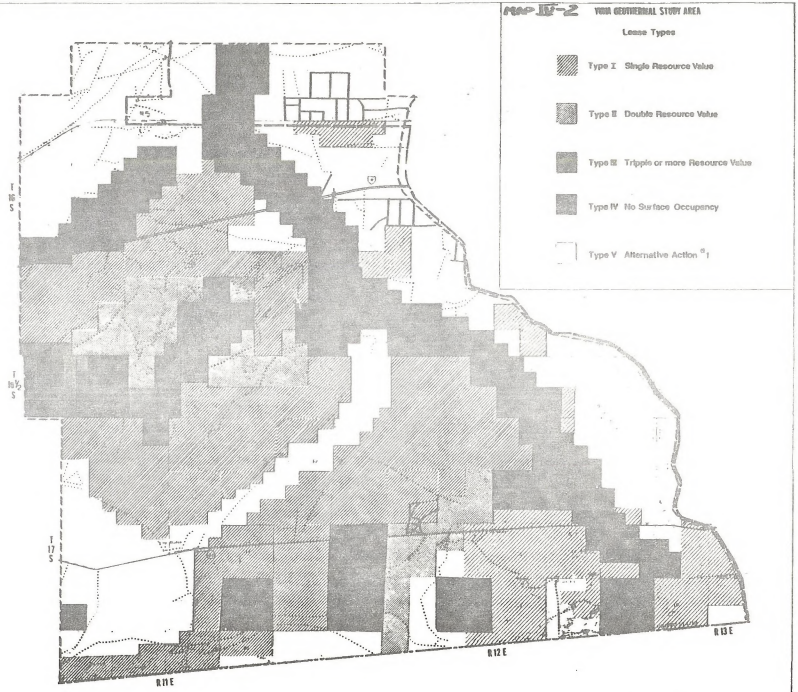
Visual Resources

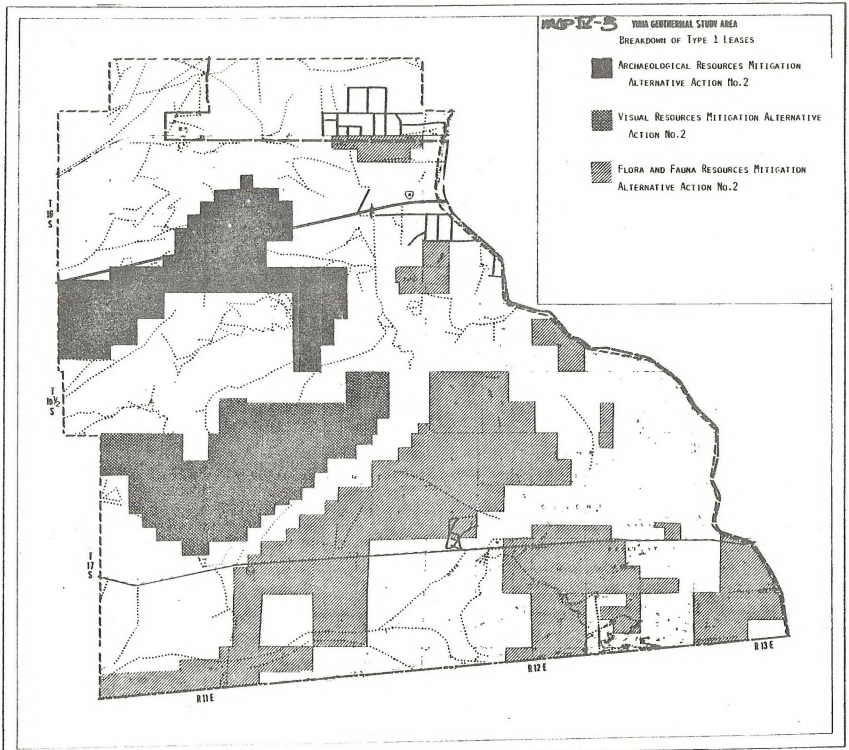
1. Multi-well drilling islands and directional drilling will be used to lessen the visual contrasts and to reduce the number of disturbance locations within the study area. (POM)

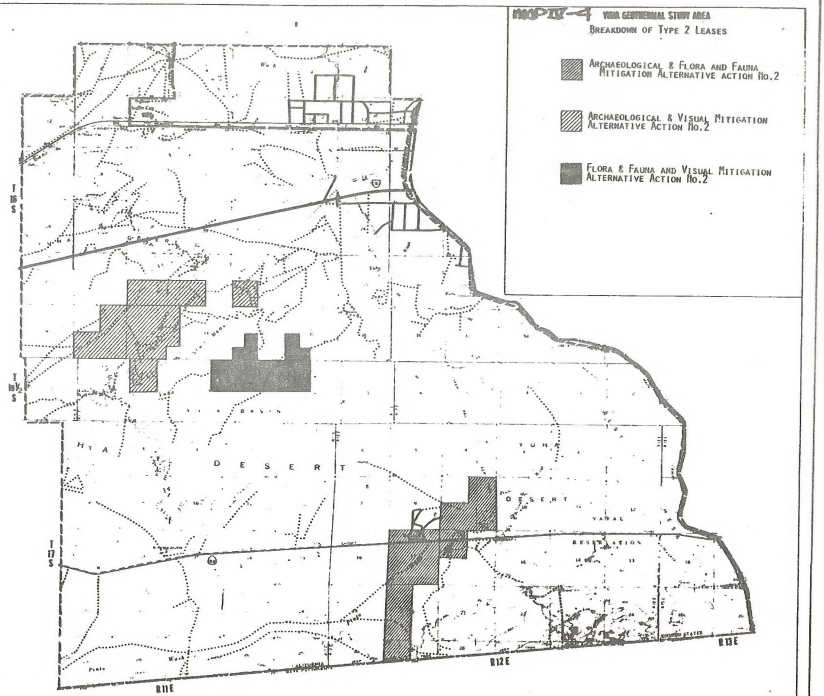
Recreation

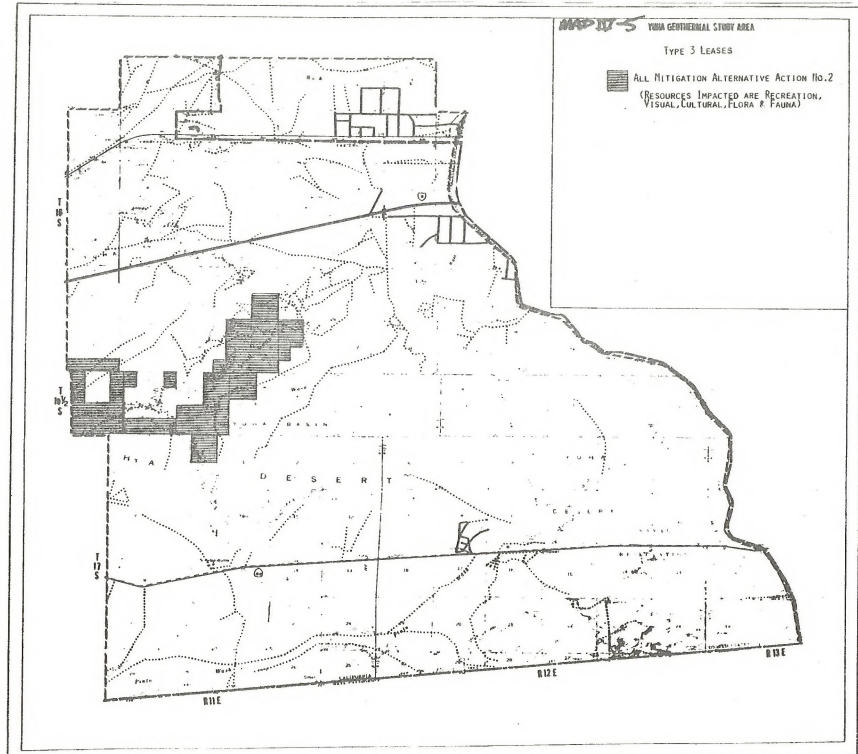
1. Recreational locations designated by the Yuha MFP will be provided with permanent protection by the withdrawal of surface access to these areas in the geothermal leases. (LS)

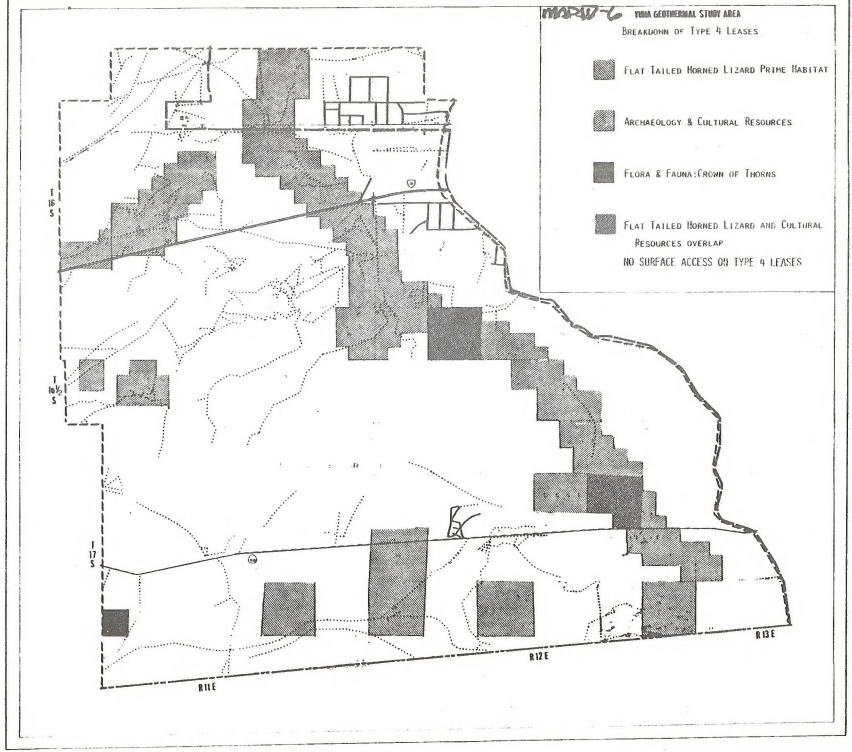

MAP IIE-1
YUHA GEOTHERMAL STUDY AREA
Land Designations
CLASS 4 OUTSTANDING NATURAL AREA
INTERPRETIVE SITES PROPOSED IN YUHA MFP
NATIONAL RECREATION LAND BOUNDARY
CLASS 3 NATURAL ENVIRONMENTAL AREA
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E
D E S E R T

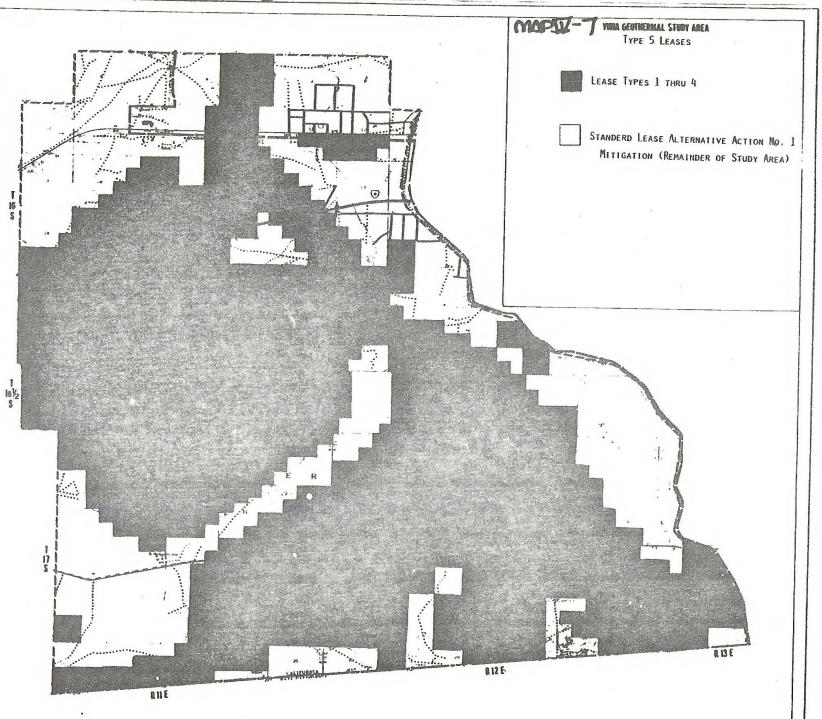

Map III-2
YUMA GEOTHERMAL STUDY AREA
Lease Types
Type I Single Resource Value
Type II Double Resource Value
Type III Tripple or more Resource Value
Type IV No Surface Occupancy
Type V Alternative Action *1
T 11 S
T 11½ S
T 12 S
R11E
R12E
R13E


MAP IV-5
YUMA GEOTHERMAL STUDY AREA
BREAKDOWN OF TYPE 1 LEASES
ARCHAEOLOGICAL RESOURCES MITIGATION ALTERNATIVE ACTION No.2
VISUAL RESOURCES MITIGATION ALTERNATIVE ACTION No.2
FLORA AND FAUNA RESOURCES MITIGATION ALTERNATIVE ACTION No.2
T 16 S
T 16½ S
T 17 S
R11E
R12E
R13E


MAP IV-4 YUMA GEOTHERMAL STUDY AREA
BREAKDOWN OF TYPE 2 LEASES
ARCHAEOLOGICAL & FLORA AND FAUNA MITIGATION ALTERNATIVE ACTION No.2
ARCHAEOLOGICAL & VISUAL MITIGATION ALTERNATIVE ACTION No.2
FLORA & FAUNA AND VISUAL MITIGATION ALTERNATIVE ACTION No.2
T 16 S
T 16½ S
T 17 S
D E S E R T
YUMA
DESERT
MARAL
RESERVATION
R11E
R12E
R13E


MAP IV-5
YUMA GEOTHERMAL STUDY AREA
TYPE 3 LEASES
ALL MITIGATION ALTERNATIVE ACTION NO.2
(RESOURCES IMPACTED ARE RECREATION, VISUAL, CULTURAL, FLORA & FAUNA)
T 18 S
T 18½ S
T 17 S
R 11 E
R 12 E
R 13 E
DESERT


MAP IV-6
YUMA GEOTHERMAL STUDY AREA
BREAKDOWN OF TYPE 4 LEASES
FLAT TAILED HORNED LIZARD PRIME HABITAT
ARCHAEOLOGY & CULTURAL RESOURCES
FLORA & FAUNA: CROWN OF THORNS
FLAT TAILED HORNED LIZARD AND CULTURAL RESOURCES OVERLAP
NO SURFACE ACCESS ON TYPE 4 LEASES
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E


MAP IV-7 VINA GEOTHERMAL STUDY AREA
TYPE 5 LEASES
LEASE TYPES 1 THRU 4
STANDERD LEASE ALTERNATIVE ACTION No. 1
MITIGATION (REMAINDER OF STUDY AREA)
T 16 S
T 16½ S
T 17 S
R 11 E
R 12 E
R 13 E

2. Protection by withdrawal of surface access to the oyster shell beds will provide protection against future demands on the area (see Map IV-1). (LS)

Land Use

1. Slant drilling from central well islands will be used as much as technically possible to minimize both the areal extent of land use changes and the conflict between present and future authorized land use. (LS)

2. Sites for future well islands, roads, powerplants, and transmission corridors will be selected by a process which will provide maximum protection of surface resources, when technically feasible. (LS)

Noise

1. When technically possible, sites of proposed development will be selected to provide for the maximum separation between the noise source and any sensitive receptors. (LS)

2. Truck traffic to and from development activities within the study area shall be limited to daylight hours to avoid high noise levels during late evening and early morning hours. (POM)

Flora and Fauna

1. Development site selection shall avoid, when technically feasible, mesquite hummocks, other sensitive plant locations, and washes. (LS)

0. Mitigation Alternative Action #3

No mitigation is offered.

V. UNAVOIDABLE ADVERSE IMPACTS

A. Geology - Actions #1 and #2

Tectonically induced subsidence, uplift and horizontal movements are a regional phenomena created by high levels of seismic events. Detailed monitoring of permanent seismic stations and first order leveling and geodetic triangulation networks provide data regarding the extent of these events. No mitigation measures can be instituted for regional earth movements.

Local occurrences of subsidence, uplift, and horizontal movements can be a result of the production and injection of fluids in a geothermal anomaly. Detailed monitoring throughout the life of geothermal activities will provide the data necessary to make determination of cause and effect. Thus, actions can be taken to eliminate cause if determined to be a result of geothermal activities. However, the effects resultant of a first event will most likely not be returnable to previous conditions.

Action #3

No impacts will occur.

B. Hydrology - Actions #1 and #2

If the unlikely event of a well blow-out or rupture were to occur, the impacts to subsurface and surface water systems would be unavoidable.

Action #3

No impacts will occur.

C. Soils - Actions #1 and #2

In the reclamation of disturbed soils condition it is impossible to return to pre-development conditions. The time period involved in the reclamation of desert communities to a natural state is long and the scars of development remain for many years.

Action #3

No impacts will occur.

D. Climatology - Actions #1, #2, and #3

There are no residual impacts foreseen.

E. Air Quality

Despite mitigating measures applied in Section IV, noncondensable gases will be released into the environment, resulting in a reduction in air quality. The odor of H_2S may be present.

Air pollutants generated by the proposed action will increase the pollution levels of the Yuha area. The proposed control methods will insure that local, state and federal standards will not be exceeded, but there still may be enough residual effects to cause some environmental deterioration.

F. Visual Resources - Actions #1 and #2

Contrasts created by transmission lines cannot be fully mitigated as some skylining will be inevitable.

Steam plumes produced from each power plant will rise above the horizon, and the plant site in the Mount Signal area will be seen even if it is located near other developments.

If development takes place in the western end of the Yuha Basin, vegetation line and textural contrasts will be seen after mitigations have been implemented.

Action #3

No impacts are foreseen.

G. Wilderness - Actions #1, #2, and #3

No residual impacts are foreseen.

H. Recreation - Action #1

Disturbance of wildlife and vegetative habitat will result in relatively permanent impacts to hunting and botanic sightseeing.

Geothermal development will most probably cause a reduction in OHV oriented visitor use due to reduction of open use areas. This impact cannot be mitigated as the specific resource values and freedom of use of the Yuha area cannot be found elsewhere in the region.

Action #2

With a reduction in geothermal development intrusion upon recreation resources, the reduction in OHV visitor use should become insignificant.

Action #3

No impacts are foreseen.

I. Socio-Economic - Actions #1 and #2

The impacts on the social and economic environs of the community are considered to be beneficial, thus, no adverse impacts are foreseen.

Action #3

The elimination from the study area of geothermal development will reduce the overall economic and social environs impacts which the local community has determined to be of a beneficial nature.

J. Land Use - Action #1

Although all stages of development will have an unavoidable adverse impact to land use, site development will be the greatest. Geothermal development requires the commitment of large land areas to a single purpose. Therefore, once land is committed, other land uses will be limited or precluded during the life of the geothermal activities.

Action #2

By reducing the areal expanse of geothermal development a much greater multi-use of land can be established. However, the land dedicated to geothermal development will not be available for other uses during the life of the development.

Action #3

No impacts are foreseen.

K. Noise - Action #1

Despite mitigation there will be some effects upon the adjacent animal communities which may cause a change in breeding and communication habits.

Actions #2 and #3

No significant adverse impacts are foreseen.

L. Cultural Resources - Action #1

Any development in the area will increase access, and with that, indirect impacts. The costs involved for protection measures are very prohibitive at this time. Although it is evident that impacts of this nature are occurring at the present, more direct access will only increase indirect impacts.

When mitigation techniques require the removal of archaeological data, there will be residual impacts in terms of future analysis techniques.

Actions #2 and #3

The residual impacts should be greatly reduced or possibly become insignificant.

M. Flora and Fauna - Action #1

Vegetation will be permanently lost in areas of intense soil disturbance because rehabilitation will not be totally successful. This will also mean lower wildlife populations or a change in diversity.

Birds will be killed because of collisions with powerlines and other structures, and animals will be crushed by vehicles and machinery. Noise during the non-breeding seasons will interrupt social behavior in birds and other animals and disrupt predator-prey interrelationships. Environmental pollutants will probably be released by accident or spillage. These pollutants may kill wildlife or the invertebrates and plants that they feed on. Of particular concern are the ants eaten by the flat-tailed horned lizard. Pollutants will also prevent vegetation growth, eliminating habitat and possibly killing sensitive plant species.

Wildlife will be subject to increased human intrusion as access will be facilitated by new roads.

Action #2

The mitigation offered for Alternative Action #2 should greatly reduce the residual impacts to a point of insignificance.

Action #3

No impacts are foreseen.

VI. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

Due to a lack of resource data, at this time it is impossible to accurately estimate the life of the proposed project. Geothermal scenarios have been presented by several authorities (LLL September 1977--Dry Lands Research Institute January 1977) which have shown diverse opinions as to the production capabilities of the geothermal resources present in Imperial County. Conservative estimates indicate a 30 year period (based on amortization of generation equipment) and the more liberal have indicated up to 50 years of possible production capability if the resource is properly managed. There are some authorities who feel that with proper resource management the geothermal resources could be a constantly renewing source of energy.

Within the next ten years with prompt exploration and a resource available, the project area would most probably be into the production phase of development. At this time, most of the significant impacts will have presented themselves.

Where land areas had been cleared for construction purposes, revegetation will require long periods of time unless artificially assisted by watering. Even then, some species may not return, thus the effects of severe soil compaction can be considered permanent. Those areas where shrubs can resprout from basal parts may revegetate quickly.

There will be some impacts to air quality because of increased dust and non-condensable gas releases. Occasionally state and federal standards would most probably be exceeded and some of these pollutants could have noxious odors.

Because of the low growth potential of the desert ecosystem, disrupted visual contrasts will remain for many years.

It is assumed within this document that within a period of time (30 years) geothermal development will be dismantled and the land surface returned to the natural processes; however, past history has shown that once industrialization is initiated, it is seldom easily reversed. Major man-made facilities involve large sums of money and are usually considered permanent. Also, rehabilitation of an area to pre-disturbance conditions cannot be done.

Since these proposed facilities will remove land surface from production or use by other resources there will be short-term (life of geothermal activities) impacts on other resource uses. Impacts felt by recreationists will generally be short term. Although those people who wish to observe the natural environment of the Yuha/Mt. Signal area may never again have the chance, access lost during the exploration and development stages will be regained with closedown. Upon closedown of geothermal activities the disturbed areas will be rehabilitated by the lessee and returned to a desert environment. However, due to the slow healing process of the desert, the scars of development will continue to exist for many years.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed geothermal development of the Yuha Basin will result in irreversible and irretrievable commitments of resources, both during the construction phase and after electrical energy production has begun. The construction phase of the project will commit limited resources in the form of building material, fuel and manpower. The power plant, production and injection wells, fluid transmission facilities, and project offices will consume steel and other metal products which constitute an irreversible commitment of limited resources. Other building materials, including asphalt for road construction, will also result in an irreversible and irretrievable commitment of limited resources. The construction phase will require using scarce fossil fuel supplies to operate construction equipment.

Extraction of the geothermal fluid for energy production will gradually diminish the commercial value of the anomaly until it is no longer economically usable. This reduction will occur despite reinjection of the fluid, if the rate of heat loss from extraction of energy exceeds the rate at which the anomaly is reheated. Although the anomaly may be reduced to non-viability it might again become productive as heat is restored over geologic time.

The commitment of the study area to geothermal development will have an irreversible and irretrievable impact upon the other surface resources available in the study area.

Considering that wilderness resource values are extremely subjective, changes in public attitudes or changes in BLM evaluation criteria may result in areas such as the Yuha Basin (current condition) again being considered as possible wilderness. Commitment of the study area to geothermal development will permanently commit potential wilderness resource values to other uses.

Any disturbance of fragile cultural material alters the data that are relevant for a precise understanding of prehistoric or historic behaviors making preservation the best alternative to insure protection of archaeological data. When it becomes imperative to mitigate direct project impacts, data recovery methods are the best tool available, even though excavation of a site destroys it and data not collected at that time are lost.

VIII. PERSONS, GROUPS AND GOVERNMENT AGENCIES CONSULTED

On July 23, 1979 an announcement was prepared by the El Centro Area Manager notifying all interested parties that a public meeting would be held August 8, 1979 to discuss the proposed non-competitive leasing of the Yuha-Mt. Signal area. This was followed by a News Release to the public issued by the Riverside District Office on the above subject changing the date of the meeting to August 2, 1979.

On that date a public meeting was held in El Centro to discuss the subject EAR and to encourage public involvement. In addition to providing an orientation to the proposed project, it was hoped that more or better information would be obtained from persons or groups in attendance and to obtain the scope of public views concerning the proposed action. However, only three members of the public attended the forum. No expressed interest in the proposal was evident as a result of this meeting. A copy of the news release announcing the meeting is shown in Chapter IV.

The draft EAR was submitted for public review in July and August 1979. A listing of the various agencies and groups which were sent a copy of the draft is presented in the following pages. Comments on the draft and BLM responses to these comments are provided in Chapter IX.

FEDERAL AGENCIES

U.S. Department of Energy
Division of Geothermal Energy
Washington, DC 20545

Environmental Protection Agency
Region IX Office
San Francisco, CA 94105

U.S. Environmental Protection Agency
Environmental Monitoring & Support Lab
Las Vegas, NV 89114

U.S. Fish & Wildlife Service
Sacramento, CA 95825

U.S. Fish & Wildlife Service
Geothermal Advisor-Region I
Boise, ID 83705

U.S. Geological Survey
Conservation Division
Area Geologist, Pacific Area
Menlo Park, CA 94025

U. S. Geological Survey
Conservation Division
Conservation Manager
Western Region
Menlo Park, CA 94025

U.S. Geological Survey
Palo Alto, CA 94303

U.S. Geological Survey
Subsidence Research
Sacramento, CA 95825

Bureau of Reclamation
Region 5
Bolder City, NV 89005

Soil Conservation Service
El Centro, CA 92243

Bureau of Land Management
Geothermal Specialist (D-310)
Denver Federal Center
Denver, CO 80225

STATE AGENCIES

Office of the Governor
State Clearinghouse
Sacramento, CA 95814

Department of Parks and Recreation
State Resource Agency
Sacramento, CA 95811

Department of Fish & Game
Region 5
Blythe, CA 92225

Public Utilities Commission
San Francisco, CA 94102

Department of Fish and Game
Sacramento, CA 95814

Water Resource Control Board
Sacramento, CA 95801

Water Control Board
Colorado River Basin Region
Palm Desert, CA 92260

Division of Oil and Gas
North Long Beach, CA 90804

Native American Heritage Commission
Sacramento, CA 95814

COUNTY GOVERNMENTS & CITY AGENCIES

Imperial County
Planning Commission
El Centro, CA 92243

Imperial County
Health Department
El Centro, CA 92243

Imperial County
Board of Supervisors
El Centro, CA 92243

Imperial County
Agricultural Department
El Centro, CA 92243

Imperial County
Air Pollution Control
El Centro, CA 92243

Imperial County
Public Works Department
El Centro, CA 92243

Imperial County
Assessor's Office
El Centro, CA 92243

SPECIAL INTEREST GROUPS

Lawrence Livermore Lab
Livermore, CA 94550

Geothermal Environmental
Advisory Panal
Menlo Park, CA 94025

San Diego Evening Tribute
San Diego, CA 92112

Geothermal Resources Council
Davis, CA 95616

University of Utah Research
Institute
Salt Lake City, UT 84105

UTILITIES, CORPORATIONS AND OTHERS

San Diego Gas & Electric
San Diego, CA 92112

Southern California Gas Co.
El Centro, CA 92243

Pacific Telephone
El Centro, CA 92243

Imperial Irrigation District
El Centro, CA 92243

Imperial County
Sheriff's Department
El Centro, CA 92243

City of Holtville
Holtville, CA 92250

Holtvill Unified School
District
Holtville, CA 92250

IVC Museum
El Centor, CA 92243

San Bernardino County Museum
Redlands, CA

Anadarko Production Co.
Houston, TX 77001

Bookman-Edmonston Eng. Inc.
Glendale, CA 91203

California Energy Company
Santa Rosa, CA 95402

CER Corporation
Las Vegas, NV 89114

Chevron USA, Inc.
San Francisco, CA 94119

Dresser Industries
Denver, CO 80202

Magma Electric Co.
Escondido, CA 92025

Republic Geothermal
Santa Rosa, CA 95401

Geothermal Power Corporation
Navato, CA 94947

Geothermal Ex, Inc.
Berkeley, CA 94707

Farm Bureau Insurance
El Centro, CA 92243

Hydro-Search, Inc.
Reno, NV 89501

ICF, Inc.
Washington, DC 20036

AMAX Exploration
Denver, CO 80212

Aminoil USA
Santa Rosa, CA 95406

Energy and Natural Resource
Consultants
Richardson, TX 75080

Gulf Mineral Resource Co.
Denver, CO 80222

Phillips Petroleum Co.
Del Mar, CA 92014

Phillips Petroleum Co.
Geothermal Operations
Salt Lake City, UT 84110

Occidental Geothermal, Inc.
Bakersfield, CA 93309

New Albion Resources Co.
San Diego, CA 92112

UTILITIES, CORPORATIONS AND OTHERS (Cont.)

Science Applications, Inc.
La Jolla, CA 92038

Getty Oil Company
Bakersfield, CA 93308

Systems, Science, & Software
La Jolla, CA 92038

Thermal Power Company
San Francisco, CA 94108

Selected Properties
Pasadena, CA 91101

Southland Royalty Co.
Fort Worth, Texas 76102

Sunoco Energy Development Co.
Dallas, TX 75251

Union Oil Company of California
Geothermal Division
Los Angeles, CA 90051

Hunt Oil Co.
Denver, CO

IX. INTENSITY OF PUBLIC INTEREST

To discern the degree of public interest concerning proposed geothermal leasing on public lands, discussions were held with various government agencies, conservation groups, other interest groups and individuals. In addition, one publicly announced meeting was held to receive public viewpoints concerning the subject EAR (see previous section on correspondence). Except for the Native American Heritage Commission, these contacts did not indicate a strong amount of State and local agency interest. The Sierra Club was the only special interest group to comment. Written comments were not received from the general public.

The draft EAR was submitted for public review and comment in August and September, 1979. Comments received and responses to them are as follows. A total of four letters were received addressing various aspects of the Yuha-Mt. Signal geothermal leasing. All of the comments received were neutral as far as indicating support for a specific alternative, although both the U.S. Geological Survey and the Resources Agency of California did mention that impacts to wildlife and habitat would be less under Alternative #2. The Sierra Club pointed out that the Yuha Basin was one of the most environmentally sensitive in the Imperial Valley that has been proposed for geothermal exploration. They recommended the entire upper Yuha Wash basin area be permanently excluded from leasing proposals. The Native American Heritage Commission recommended an EIS be prepared to ensure appropriate environmental safeguards would be taken to comply with requirements of the National Environmental Policy Act.

UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Riverside District Office
1695 Spruce Street
Riverside, California 92507

IN REPLY REFER TO:
(C-067.01)
1791

TO : All Interested Parties

Date: JUL 24 1979

FROM : District Manager, Riverside

SUBJECT: Draft Environmental Assessment Record for Proposed Non-competitive Geothermal Leasing in the Yuha Basin, Imperial County, California

Enclosed is a copy of the Draft Environmental Assessment Record for Proposed Geothermal Leasing in the Yuha Basin Area of California. This EAR analyzes the general impacts which would result from geothermal development in this area. The impacts of subsequent plans of operation, prepared by the lessee, will be addressed in site specific Environmental Analyses (EA's). These will be prepared by United States Geological Survey (USGS).

If you have any questions concerning this document please call Joseph Edney at (714) 352-5842 or FTS-894-2451, or Roger Haskins at (714) 787-1649 or FTS-796-1649.

Please address any comments you may have concerning this EAR to:

Area Manager (C-067.01)
El Centro Area Office
Bureau of Land Management
333 Waterman
El Centro, CA 92243

All comments will be considered in the preparation of the final Environmental Assessment Record for this area. We would appreciate receiving all comments within 30 days of the date of this memorandum. Thank you.

Edward Eckhardt

DSC-1541-2

3250.3
(C-067.01)

333 S. Waterman Ave.
El Centro, CA 92243

To All Interested Parties:

The Draft Environmental Assessment of the proposed non-competitive leaseing of the Yuha/Mt. Signal Study Area is complete and will soon be in the mail.

A public meeting on the Yuha/Mt. Signal EA will be held Thursday, August 8, 1979, at the Imperial Irrigation District auditorium from 7:00 p.m. to 10:00 p.m., the address of the IID auditorium is 1284 Main Street, El Centro, California. A map showing the location of the auditorium is attached.

Sincerely yours,

David L. Mari
Area Manager
El Centro Resource Area

C-067.01:JEdney:sr:7-23-79:352-5842

3280.3
(C-067.01)

333 S. Waterman Ave.
El Centro, CA 92243

JUL 27 1979

To All Interested Parties:

Please be corrected on the date of the Public Hearing on the Yuha/Mt. Signal Enviromental Analysis. Previous communication (7/23) indicated the meeting was to be held Thursday August 8, 1979, this should be changed to Thursday August,2, 1979.

Sincerely yours,

/s/ Robert W. Schneider

David L. Mari Acting
Area Manager
El Centro Resource Area

C-067.01:JMEdney:sr:7-26-79:352-5842

CALIFORNIA BLM BUREAU OF LAND MANAGEMENT

FOR RELEASE
CONTACT RDO #79-17

July 30, 1979
Joseph M. Edney
(714) 352-5842

News Release

UNITED STATES DEPARTMENT OF THE INTERIOR
Riverside District Office 1695 Spruce Street, Riverside, California 92507

Public Meeting

The draft environmental assessment of the proposed non-competitive leasing of the Yuha/Mt. Signal geothermal study area is complete and will soon be in the mail. A public meeting on the Yuha/Mt. Signal EA will be held Thursday, August 2, 1979, 7-10 p.m., at the Imperial Irrigation District Auditorium, 1284 Main Street, El Centro.

The EAR is available for review at the BLM El Centro Resource Area Office, 333 S. Waterman, and the Riverside District Office, 1695 Spruce Street, Riverside.

Comments should be sent to El Centro Resource Area Office, ATTN: J.M. Edney, Environmental Specialist, Project Manager, by August 29, 1979.

State of California
GOVERNOR'S OFFICE
OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO 95814
(916) 445-0613

EDMUND G. BROWN JR.
GOVERNOR

August 6, 1979

Area Manager
El Centro Area Office
Bureau of Land Management
333 Waterman
El Centro, CA 92243

SUBJECT: SCH 79081503 - GEOTHERMAL LEASING - YUHA BASIN

Dear Sir/Madam:

The State of California requests an additional 30 days in order to complete the review of the project identified above.

Should the time extension be granted, the review would be completed on September 22, 1979 and the comments will be forwarded to you not later than September 29, 1979.

Thank you for your assistance. We are confident the additional review time will result in comments more useful to the sponsor.

Sincerely,

Stephen Williamson

Stephen Williamson
State Clearinghouse

OFFICE OF THE GOVERNOR
OFFICE OF PLANNING AND RESEARCH
STATE CLEARINGHOUSE
1400 - 10TH STREET
SACRAMENTO, CA 95814

U.S. DEPT OF INTERIOR
333 WATERMAN
EL CENTRO CA 92243
ATTENTION: AREA MANAGER

ACKNOWLEDGEMENT 08/11/79
REPORT IMD45A

PROJECT NOTIFICATION AND REVIEW SYSTEM
OFFICE OF THE GOVERNOR
(916) 445-0613

PROJECT: GEOTHERMAL LEASING - YUHA BASIN

STATE CLEARINGHOUSE NUMBER (SCH) 79081503

PLEASE USE THE STATE CLEARINGHOUSE NUMBER ON FUTURE CORRESPONDENCE WITH THIS OFFICE AND WITH AGENCIES APPROVING OR REVIEWING YOUR PROJECT

DATE RECEIVED: 79/08/03

DATE REVIEW PERIOD ENDS: 79/09/20

THIS CARD DOES NOT VERIFY COMPLIANCE WITH PREAPPLICATION AND/OR ENVIRONMENTAL DOCUMENT REVIEW REQUIREMENTS. A LETTER CONTAINING THE STATE'S COMMENTS OR A LETTER CONFIRMING NO STATE COMMENTS WILL BE FORWARDED TO YOU AFTER THE REVIEW IS COMPLETE

PLEASE CONTACT THE CLEARINGHOUSE IMMEDIATELY IF YOU DO NOT RECEIVE THE LETTER BY THE END OF THE REVIEW PERIOD.

SIERRA CLUB

FOUNDED IN 1892

SAN DIEGO CHAPTER
HOUSE OF HOSPITALITY
1549 EL PRADO, BALBOA PARK
SAN DIEGO, CALIFORNIA 92101

August 18, 1979

Area Manager
Bureau of Land Management
333 Waterman
El Centro, CA 92243

Dear Sir:

The Sierra Club has reviewed the DMRO for the Yuha Desert-Signal non-competitive leases, and finds that in general it addresses most of the areas of concern that surround these proposed leases.

However, we would raise the criticism that there occasionally seems to be insufficient emphasis given to some of the most unique aspects of this area, and the severity of possible impacts to them. Outstanding local features (such as the fossil oyster beds) should be emphasized, not merely mentioned in passing (as on page 11). 1-

Additionally, the indirect impacts on the unique cultural and geologic resources of the area caused by opening up the Yuha Basin area to a higher level of public accessability, combined with a low ability to adequately police the area, should be given greater emphasis. It is barely mentioned (pp. 90, 96, and 117), and could be the most damaging aspect of all. Concern over the probable increases in the rate of destruction of the fossil beds if leasing is allowed seems not to be mentioned at all, and should be. 2-

The Sierra Club has identified the Yuha Basin as one of the most environmentally sensitive of the Imperial Valley areas that BLM has proposed for geothermal exploration. The position of the Sierra Club remains that any geothermal drilling within the Yuha Basin should be carried out only in areas devoid of significant cultural and geological artifacts, if at all. The entire upper Yuha Wash basin area in particular, containing Yuha Well, the intaglio, the fossil beds, etc., should be permanently excluded from this and future leasing proposals as a partial mitigation measure for any development or exploration allowed in the remainder of the study area.

Yours truly,

Philip R. Pryde

Philip R. Pryde
Southern California Geothermal Coordinator, Sierra Club

BUREAU OF LAND MANAGEMENT RESPONSE TO COMMENTS FROM:

Sierra Club
San Diego Chapter
1549 El Prado Balboa Park
San Diego, CA 92101

Comment #	Response
1	The text has been revised to give additional emphasis to the fossil oyster beds located in the area. Any decision will take into consideration their importance locally and regionally as a unique resource.
2	Comment noted. The text has been revised to point out the potential for destruction or vandalism with increased access (page 72).

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

SEP 6 1979

Memorandum

To: Area Manager, Bureau of Land Management, El Centro, CA

From: Area Geothermal Supervisor

Subject: Review of Draft Environmental Assesment Record on Proposed Non-competitive Geothermal Leasing in the Yuha Basin, Imperial County, California

As requested in a July 24, 1979 memorandum from the U. S. Bureau of Land Management, Riverside District, Riverside, California, the Draft Environmental Assessment Record for Proposed Non-competitive Geothermal Leasing in the Yuha Basin, Imperial County, California has been reviewed by this office.

The E.A.R. is generally well written and satisfactorily considers most of the environmental considerations associated with the proposed 100 MW power plant project. Most of our comments are directed toward apparent inadequacies of the ecological narrative of the E.A.R. or are editorial in nature. Comments on the E.A.R. are attached.

Should you have any questions concerning the comments, please contact Ralph Kimmel of this office (FTS 467-2848).

Reid T. Stone

Attachment:

COMMENTS ON THE DRAFT E.A.R. ON PROPOSED NON-COMPETITIVE GEOTHERMAL LEASING IN THE YUHA BASIN, IMPERIAL COUNTY, CALIFORNIA

1. INTRODUCTION AND DESCRIPTION OF PROPOSED ACTION

Development Model

p9 5. Closedown, lines 2-5 read: "This phase will include the removal of all facilities, abandonment of all wells, and the rehabilitation of the impacted surface. Well abandonment and pad rehabilitation will also take place during phases 3 & 4". Under SHORT-TERM vs LONG-TERM PRODUCTIVITY, on p. 120, line 5, the last paragraph reads, "upon close down of geothermal activities the disturbed areas will be allowed to return to a desert environment".

It is not clear if the site will be abandoned and allowed to return to its former environment naturally, or if it will be rehabilitated or restored
1- in some way such as by levelling, reseeding, etc. If rehabilitated, who is responsible?

Proposed Action and Alternatives

p6 lines 1 & 2: Suggest rewording of this sentence for greater clarity
2- as follows: "c) Permanent development will be restricted to non-sensitive areas unless access to sensitive areas is shown to be necessary."

2. DESCRIPTION OF THE EXISTING ENVIRONMENT

Geology

p11. The Geology Section might flow better if it were reorganized ac-
3- cording to the following outline:

1. Physiography and Topography
2. General Geology
3. Sedimentation and Stratigraphy
   (including "Ancient Freshwater Lakes")
4. Tectonism and Structure

A suggested rewrite of the Geology Section is attached to use as you may wish. In addition to reorganizing the subsections, their content has in some cases been modified. (Please see attachment)

p12. Table II-1 The time units should be labelled along the side of the
4- stratigraphic column.

Example:

Quaternary	Alluvium (Qal. Qt)
Tertiary	Cane brake Conglomerate (T_c)
	Split to Formation (T_s)
Palazoic	Shist, Limestone: Gneiss: Grantic Intrusives

5- p13. Map II-1 Where known, down thrown/upthrown symbols should be shown on

the faults, as this information is discussed in the text.

6- p13. A structural symbol should be used to show the domal structure described in the text.

Noise

7- p46. Table II-7, Can SPL units shown as "SPL INdB RE 20uPa" on this chart be shown as "SPL in dB(A)" to be less confusing and in conformity with the units noted in the text? Also, a short explanation of what values of measurement of "dBA" and "dBL" mean would be helpful.

3. IMPACTS TO THE EXISTING ENVIRONMENT

Geology

8- p68. Action #1, Impact #2. More detailed descriptions of the effects on seismicity and subsidence in Impacts #3 and #4 render this impact description redundant and unnecessary. We suggest that reference simply be made to this discussion in Sections #3 & #4.

9- p69. Impact #4 Line 3. Suggested word change ----a large magnitude seismic event-----

10- p69. Impact #5. This impact does not contribute to the impact analysis and can probably be eliminated.

Land Use

11- p86. Action #2. Potential land use impacts under alternative Action #2 should also be discussed. Impacts under Action #2 should differ somewhat from impacts noted under alternative Action #1, and should be identified if possible.

Noise

12- p86. While tables III-2, III-3, and III-4 present valuable information, reference to the tables within the narrative portion of this report would increase their significance. This is particularly true when they are cited as an illustration.

13- p86. Is the last paragraph on this page impact no. 1 under Action #1?

4. MITIGATING MEASURES

Geology

14- p103 2b. This measure is a requirement of GRO Order No. 4 and is required by USGS-BLM Memorandum of Understanding 2948.

Soils

15- p104 item 5. Suggested rewording: "Cut banks and fill areas will be sloped so as to prevent slope failure and minimize erosion.

16- p103-104, Items 1,3,5. These measures are requirements of GRO order No.4 or are required by USGS-BLM Memorandum of Understanding 2948.

Land Use

17- p107 J.1.a Suggest revision to one sentence rather than two sentences.

p107 J.1.b. Suggest revision to one sentence rather than two sentences.

Climatology and Air Quality

18- p105 Lines 5 and 6 "Daily records will be kept and monthly reviews made by the Office of the Area Geothermal Supervisor, USGS, Menlo Park, California" should be deleted. This is not current practice, nor is the need for it clear. Should conditions require such attention, the office of the AGS will obtain and review records on air quality, and take appropriate action as necessary.

19- p105 Item 2. More emphasis might be placed on the significance, frequency and seriousness of Valley Fever plus specific mitigating measures such as possible dust control, innoculations, etc.

Land Use

20- p107. Conflicts between land use allocations are discussed, but mitigating measures for potential land use impacts are not, and should be added.

Noise

21- p107-108. Cooling tower noise is mentioned as a source of noise with potential for impact beyond project boundaries because its frequency distribution makes it more difficult to attenuate (p90). Is it possible to mitigate this noise. If not, can location siting reduce this impact?

22- p108 Items 2 and 3. Drilling operations are a 24 hour activity and the necessity for equipment or supply deliveries cannot be scheduled during daylight hours only. Drilling problems can occur at any time and very often require immediate delivery of supplies which are not kept on hand. Therefore, this stipulation is unreasonably strigent.

A suggested revision might be: "2. While deliveries of supplies and equipment by heavy truck should not be limited to daylight hours only, such deliveries should be made during daylight hours whenever possible to reduce the frequency of nighttime noise disturbances.

A suggested revision might be: "3. Should noise levels resulting from the stacking and making up of drill line during drilling operations become a problem, construction of an acoustical baffle may be necessary to reduce the noise level.

p109 M. 1. Any activity would increase the noise level above the ambient level and restricting a lessee's operation for 5 months of the year is an unreasonable stipulation when no unique species are affected.

5. GENERAL COMMENT PERTAINING TO THIS E.A.R.

1. All maps should show a north arrow, scale, and identify township range and major roads and highways. (ej. p35)

2. When possible, references should be noted in the narrative for important reports, conclusions, and tables (ej. p23, 27, 30, 105, and 106).

3. Appendix C, "Cultural sequence of the Yuha Area -----" is well presented and provides excellent background information on the important archeological history of the area.

4. The analysis of impacts to visual resources in the area, (pp74-77) appears to be a well conducted comprehensive study employing sound evaluation techniques.

5. A topographic map should be included in the report.

6. The concept of developing mitigating measures for future plans is essentially a duplication of effect. Site specific stipulations will be developed when an EA is written concerning a particular P.O.O.. Only lease stipulations should be addressed in this E.A.R..

SUGGESTED REWRITE OF THE GEOLOGY SECTION

A. Geology

1. Physiography and Topography

The Yuha Basin is located in the Southern California portion of the Colorado Desert Physiographic Province along the southwest flank of the Salton Trough. This area consists primarily of a nearly flat-lying desiccated lake-bed plain. The Yuha Buttes, Mt. Signal and Sunrise Butte provide the only topographic relief in the study area, rising as much as 200' above the basin floor.

2. General Geology

The study area is underlain by sedimentary rocks which range in age from mid-Tertiary to Recent (see Table II-1). These units have an estimated total thickness of between 6700' and 9200' and unconformably overlie older basement rocks (Black, 1974), which probably consist of metamorphics and siliceous intrusives (Dibblee, 1954).

3. Sedimentation and Stratigraphy

The oldest stratigraphic unit exposed in the study area is the Pliocene Imperial Formation. This marine formation which crops out in the Yuha Buttes contains fossil oyster shell beds, and is composed primarily of interbedded sandstones and siltstones with scattered thin layers of gypsum. These units are overlain by the Pleistocene Palm Springs Formation composed of non-marine sandstones, shales, and clays. The clay, shale, and silt beds of this and the Imperial Formation form unstable slopes which have eroded into a minibadlands type topography around the Yuha Buttes.

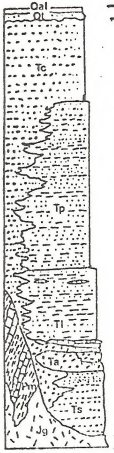
Younger alluvial deposits composed of sand, clay, and scattered gravel beds overlie the Imperial and Palm Springs Formations. In addition, several freshwater lakes have covered the Imperial Valley including portions of the study area in the recent geologic past. Lake Le Conte inundated the region during Pleistocene times and more recently Lake Cahuilla began to form roughly 1800 years ago and lasted approximately 1300 years. The Lake Cahuilla formation composed of fertile lakebed clays and silts forms the prime agricultural land of Imperial County.

4. Tectonism and Structure

The Salton Basin Region is a tectonically active area formed by the same crustal plate movement and interaction which has resulted in the development of the San Andreas and San Jacinto fault systems. Strike slip movement along these fault systems controls the geologic structure within the study area. The Elsinore-Laguna Salada fault and a smaller unnamed fault transect the area of interest, trending in a northwesterly direction parallel to the San Andreas and San Jacinto fault systems (see map II-1). Although no movement has been recorded along the

Elsinore-Laguna Salada fault during the past 200 years, the smaller fault near Dixieland has been active during that period. This latter fault is thought to be a segment of the Coyote Creek fault which is part of the San Jacinto fault system. In addition, there are several other small local faults within the study area but their movement is not known.

Compressional stresses on the upthrown side of the Elsinore-Laguna Salada fault have produced a northeast trending structural dome within the study area. This feature has been breached by erosion, exposing the oldest units of the Imperial Formation along the crest of the anticline (Streiff, 1971).



Quaternary — ALLUVIUM AND TERRACES (Qal. Qt) 0-300 feet gravel, sand unconformity

CANEBRAKE CONGLOMERATE (Tc) 0-9,000 feet gray conglomerate of granitic and metamorphic debris, grading westward into massive granitic fanglomerate.

PALM SPRING FORMATION (Tp) 0-6,500 feet interbedded light gray arkosic sandstones and reddish clays; terrestrial; grades westward into Canebrake Conglomerate.

Tertiary

IMPERIAL FORMATION (Ti) 0-3,800 feet light gray claystone and lesser interbedded arkosic sandstones: calcareous oyster-shell reefs common; basal 0-50 foot bed of fossiliferous calcareous sandstone; marine.

FISH CREEK GYPSUM (Tf) 0-100 feet (Fish Cr. Mtns. only)

ALVERSON ANDESITE (Ta) 0-700 feet andesite lava, breccia, and tuff.

SPLIT MOUNTAIN FORMATION (Ts.) 0-2,700 feet gray conglomerate of granitic debris, dioritic breccia, hard buff sandstone, red arkosic sandstone and conglomerate.

Paleozoic — unconformity

SCHIST, LIMESTONE; GNEISS: GRANTIC INTRUSIVES

(after Dibblee, 1954)

TABLE II-1 General Columnar Section

BUREAU OF LAND MANAGEMENT RESPONSE TO COMMENTS FROM:

U.S. Geological Survey, USDI
Area Geothermal Supervisor's Office
Menlo Park, CA 94025

Comment #	Response
1	During the close-down phase disturbed areas will be rehabilitated by the lessee and allowed to return to a desert environment.
2	Text revised to provide clarity.
3	No response necessary.
4	Table II-1 has been revised to indicate time limits along this side of the stratigraphic column.
5	Map II-1 has been revised to indicate fault structuring.
6	Domal structure is shown on Map II-1.
7	SPL INdb RE 20uPa encompasses a wider range of frequencies than SPL,s in dB(A). An explanation of methodology and terms can be found in B.H. Brattstram's report on file in the Riverside D.O.
8	Text unchanged.
9	Revised with comment.
10	Impact discussion deleted.
11	Text revised. The major impact resulting from implementation of alternative #2 would be the development of geothermal energy in the area thereby providing a greater diversity of land uses than now present. With mitigation, the project as proposed would allow other uses, (wildlife, recreation etc.) to continue.

U.S. Geological Survey, USDI
(Continued)

Comment #	Response
12	Tables III-2, III-3, and III-4 provide a summary description of the range of operational noise levels which could be expected with implementation.
13	This paragraph refers the reader to the flora and fauna section for further information. The impact discussion has been renumbered to clarify your comment.
14	Mitigating measure 2b. has been deleted.
15	Revised to reflect comment.
16	Item 1 has been deleted. Items 3 and 5 are general requirements of GRO order No. 4 and MOU 2948. Additional detail has been provided to clarify construction techniques required to minimize or prevent slope failure and erosion.
17	The plan for exploration can be approved by the County. However, for the 2nd step in development to occur, the area must be identified as a KGRA. This can occur several ways. The lessee can provide information (test results) to the County for evaluation and, after verification, adjust the geothermal element to confirm to the KGRA. The second method would be for USGS to designate, at the initiative of the lessee, the Yuha area as a KGRA; whereby the County could then make an immediate adjustment in the existing geothermal element.
18	The lessee will establish and operate an air quality and meteorological monitoring system to assess and quantify the impact of the H_2S emissions on ambient air quality. Currently, the closest monitoring station is in Seeley at the Naval facility (7 to 8 miles) and it does not monitor for H_2S emissions.

U.S. Geological Survey, USDI
(Continued)

Comment #	Response
19	A discussion of Valley Fever and the likelihood of infection due to earth disturb ing operations is included in the air quality impact section (page 59).
20	Mitigating measures to reduce or alleviate the impacts of geothermal resource development are included in this report. Additional measures would be developed as more specific information becomes available.
21	Cooling tower noise is a noise source with a high potential for long-term impacts beyond plant site boundaries, because the frequency distribution is over such a range it is difficult to attentuate through mechanical design. Thus, during the plant site selection and design process, a primary criteria of review would be to provide for the maximum possible separation between the noise source and sensitive reception locations. An additional criteria would be to form attentuation baffles.
22	Text revised to conform with your recommendations.
23	Text has been revised. Noise levels would be at the discretion of the Authorized Officer as stated on page 85, Item No. 1.
24	General comments noted. No response necessary.

OFFICE OF THE SECRETARY
RESOURCES BUILDING
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Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Navigation and Ocean Development
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

1979 SEP 19

Area Manager (C-067.01)
El Centro Area Office
Bureau of Land Management
333 Waterman
El Centro, CA 92243

Dear Sir:

The State of California has reviewed the Environmental Assessment Record Draft for Proposed Geothermal Leasing Yuha Basin, which was submitted through the Office of Planning and Research (State Clearinghouse) in the Governor's Office.

The Department of Fish and Game (DFG) stated that the draft environmental assessment adequately presented the probable impacts of the proposed geothermal leasing. However, under Proposed Action 1, Leasing of All Lands, the impacts to the wildlife and habitat will require extensive mitigation. Without adequate mitigation, the DFG would be in opposition to this type of geothermal leasing. Proposed Action 2 greatly reduces the impacts to wildlife and its habitat, and it appears that the proposed mitigation measures for this proposal are adequate to protect the resource.

1- Of major concern to the DFG is the proposal to open these lands to unrestricted ORV activity. The mitigation measures proposed under Action 2 would be of little value if the sensitive areas are destroyed by ORVs.

The final environmental assessment should describe specific measures to prevent ORV damage to the sensitive areas in the Yuha Basin. These proposals should be viable and realistic. If you have any questions, please contact Mr. Fred A. Worthley Jr., Regional Manager, Region 5, 350 Golden Shore, Long Beach, CA 90802. The telephone number is (213) 590-5113.

The State's review, which fulfills the requirements of Part II of Office of Management and Budget Circular A-95, was coordinated with the Departments of Conservation, Fish and Game, Food and Agriculture, Health Services, Parks and Recreation, and Water Resources; the Air Resources, Solid Waste Management,

and State Water Resources Control Boards; and the State Lands Commission.

Thank you for the opportunity to review and comment on your draft report.

Sincerely,

James W Burns

JAMES W. BURNS
Assistant Secretary for Resources

cc: Director of Management Systems
State Clearinghouse
Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814
(SCH No. 79081503)

BUREAU OF LAND MANAGEMENT RESPONSE TO COMMENTS FROM:

The Resources Agency of California
Office of the Secretary
Sacramento, CA 95814

Comment #	Response
1	The proposal does not open the study area to unrestricted ORV activity. Map II-6 on page 25 delineates OHV use areas and types of restrictions applied. Rather than increasing the number of OHV visitors, geothermal development would most likely cause a reduction in OHV visitor use due to necessary reductions of open use areas.

State of California
Governor's Office

Native American Heritage
Commission

Stephen M. Rios Esq.
Executive Secretary

October 11, 1979

Mr. David L. Mari
Area Manager
El Centro Resource Area
Bureau of Land Management
333 S. Waterman Avenue
El Centro, California 92243

Dear Mr. Mari:

We would like to take this opportunity to express our initial comments on the preparation of an environmental analysis record discussing the proposed issuance of non-competitive geothermal leases in the Glamis/Dunes area.

Recommendations on documenting Native American heritage resources and concerns in accordance with environmental law and policy are enclosed to assist you in addressing cultural heritage issues as they relate to this project.

Preparation of an Environmental Impact Statement in accordance with the Council on Environmental Quality's 40 C.F.R. Part 1500 regulations is urged in order to ensure that the appropriate environmental safeguards are generated in accordance with the requirements of the National Environmental Policy Act.

1-

Sincerely,

Stephen M. Rios
Executive Secretary

SMR:js

Enclosure

cc: James B. Ruch
State Director
Bureau of Land Management
2800 Cottage Way
Sacramento, California 95825

1400 Tenth Street, Sacramento 95814 (916) 322-7791

BUREAU OF LAND MANAGEMENT RESPONSE TO COMMENTS FROM:

State of California
Native American Heritage Commission
Sacramento, CA 95814

Comment #	Response
1	The Department of Interior, Bureau of Land Management, is in compliance with established procedures set by the Federal Advisory Council on Historic Preservation and California Office of Historical Preservation for satisfying the requirements of existing cultural environmental law and policy. A Class III inventory (100%) would be required prior to any ground disturbance in accordance with 36 C.F.R. Part 800. Specific mitigation would be developed after these studies are completed to avoid impacts to cultural and Native American heritage resources in the area.

State of California
Governor's Office

Native American Heritage Commission

Stephen M. Rios Esq.
Executive Secretary

Commissioners

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Pit River

DOCUMENTING INDIAN HERITAGE RESOURCES AND CONCERNS IN ACCORDANCE WITH ENVIRONMENTAL LAW AND POLICY

1. Authority and Purpose

The California Native American Heritage Commission (NAHC) was established in 1976 (Chapter 1332, Stat. of 1976; Division 5, Section 5097.9, Public Resources Code). The Commission consists of nine California Native Americans appointed by the Governor with the advice and consent of the Senate. The Governor also appoints the Executive Secretary of the Commission. The Office of the Executive Secretary in Sacramento is an autonomous unit administered within the Governor's Office of Planning and Research.

The Commission's legal authority includes making recommendations to encourage private property owners to protect and preserve sacred places in a natural state and to allow appropriate access to Native Americans for ceremonial or spiritual activities. The Commission is authorized to assist Native Americans in obtaining appropriate access to sacred places on public lands. The Commission is further authorized to aid state agencies in any negotiations with federal agencies for the protection of Native American sacred places on federally administered lands in California.

In addition, Congress has resolved that it is the policy of the United States "to protect and preserve for Native Americans their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian," including access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites (Public Law 95-341; 92 Stat. 469; 42 U.S.C. 1996). Federal authorities responsible for administering relevant laws have been directed to evaluate policies and procedures in consultation with traditional religious leaders in order to determine changes necessary to protect Indian cultural rights and practices.

It is appropriate, therefore, for the NAHC to issue recommendations on the documentation of Indian heritage resources and concerns in accordance with environmental law and policy in order to assist agencies and individuals in meeting these and other heritage preservation objectives.

2. Meeting the objectives of Heritage Preservation through Environmental Law

Section 101(b)(4) of the National Environmental Policy Act (NEPA) states that one objective of national environmental policy is to "preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment

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which supports diversity and variety of individual choice." Similarly, the California Legislature has declared in Section 21001(b) of the California Environmental Quality Act (CEQA) that it is the policy of the State to "take all action necessary to provide the people of this state with . . . enjoyment of aesthetic, natural, scenic, and historic environmental qualities." State and federal authorities have accordingly adopted manditory procedures and guidelines by which the adverse effects of any significant physical undertaking or decision upon the cultural environment in general and heritage resources in particular must be considered. These are codified under 40 C.F.R. Part 1500 (see also 43 FR 55978-56007, November 29, 1978) and California Administrative Code, Title 14, Division 6.

All public agencies and government authorities initiating or approving a project or undertaking are legally obligated, therefore, to coordinate compliance with federal and state environmental law and policy with the identification and protection of those places and values which have special heritage, religious, or social significance to contemporary California Native Americans.

3. Cultural Environmental Law and Policy

The Federal Advisory Council on Historic Preservation and the California Office of Historic Preservation have established detailed procedures for satisfying the requirements of existing cultural environmental law and policy embodied in the National Historic Preservation Act (Public Law 89-665; 80 Stat. 915; 16 U.S.C. 470, as amended) and Presidential Executive Order (EO) 11593, "Protection and Enhancement of the Cultural Environment" (3 C.F.R., 1971 Comp., p. 154).

The Advisory Council has adopted procedures for implementing Section 106 of the National Historic Preservation Act and certain sections of EO 11593. These "Procedures for the Protection of Historic and Cultural Properties" are codified under 36 C.F.R. Part 800 (see also 44 FR 6068-6081, January 30, 1979). In addition, the State Office of Historic Preservation has issued a checklist of information that would be appropriate for a major cultural resource survey. This checklist is available from:

State Office of Historic Preservation
Department of Parks and Recreation
P.O. Box 2390, or 1220 "K" Street, Third Floor
Sacramento, California 95811

Compliance with these laws and procedures must also be combined to the fullest extent possible with compliance with the requirements of NEPA and CEQA. 36 C.F.R. 800 and 40 C.F.R. 1500 contain instructions on how this is to be accomplished in accordance with federal law and policy. It is particularly important that the inventory and assessment requirements of 36 C.F.R. Part 800.4(a) be demonstrated at the earliest stage of project decision-making and specifically prior to any kind of project approval or entitlement to use.

4. Cultural Resources of Heritage Significance

Cultural resources significant or sacred to California Native Americans as part of their contemporary heritage can include:

a. Burial places and cemeteries;

b. Cultural remains or deposits in an archaeological context such as lithic scatters or midden deposits;

c. Places of spiritual or social importance, such as prayer sites, ceremonial sites and shrines, areas important in legend or folklore, or areas attributed with special power or sacredness;

d. Native animals and plants used in traditional hunting, gathering, or curing practices; and

e. Physical features or natural resources important to the maintenance of traditional culture such as hot springs, obsidian outcrops, free-flowing rivers and streams, and natural landscapes.

5. Documentation

Identifying heritage resources that are significant to contemporary California Native Americans and evaluating the effects of a particular project or proposal will most often require historical and ethnographic research and nondestructive archaeological investigations. All such work must be performed by adequately qualified individuals. The accuracy or completeness of baseline inventories may be challenged if this work is not conducted by qualified persons.

The results of historical and ethnographic research should be summarized in ethnographic components of NEPA, CEQA, and related environmental documents. The purpose of including an ethnographic component is to identify and evaluate the Native American and other ethnic values of a given project area and to determine how the project will affect these values. Ethnographic components must be methodologically sound. They should be produced through a combination of library work, field study, and close contact with the ethnic community concerned with the heritage resources of a particular project area.

This area of study has grown in importance along with the recognition that all cultural resource values are not purely archaeological. Rather, a combination of ethnographic, historic, and archaeological investigations assures a full representation of the existing cultural resources for any given project or area. An ethnographic component to an environmental document should be prepared whenever there exist in any particular project area cultural resources which are non-archaeological in nature or human values which are not accessible through archaeological research.

Some of the broad topics which should be explored in any ethnographic component are:

a. Determination of the degree to which the contemporary Indian community (or other ethnic group) may be concerned about the land or other aspects of the environment within a given project area;

b. Determination of the nature of the cultural values in question and what project aspects might impact these values; and

c. Establishment of the nature and extent of all cultural resource sites likely to be affected by the undertaking and the relationship of this information to historic and contemporary oral tradition.

Sufficient data both in the form of professionally acquired narratives and properly researched primary references must be provided in support of the above topics.

The most significant aspect of any ethnographic component should be the values living populations place on heritage sites, and the recommendations they make for mitigation planning. The recommendations of the ethnographer regarding protection of the cultural resources, a statement of the significance of the identified cultural resources to the contemporary community, and a discussion of alternative recommendations for protection should also be included in the component.

6. Consultation

The Native American Heritage Commission has adopted these recommendations as a means by which to further protect socially and religiously important values and places in California. The Commission seeks to reinforce and affirm the existing cultural environmental planning and preservation process, and to assist those preparing environmental documents by providing information, by discussing the scope of the cultural evaluation, and by assisting in identifying possible resources. The Commission can also assist in gaining information from and facilitate consultation with the local Indian community.

For additional information, contact:

Native American Heritage Commission
1400 Tenth Street, Room 109
Sacramento, California 95814
(916) 322-7791

Stephen M. Rios, Executive Secretary

3/14/79

BIBLIOGRAPHY

Anspaugh, Lynn. 1976. "Potential problems to wildlife resources" in Potential Effects of Geothermal Development on Imperial Valley Ecosystems. Joseph Shinn, ed. Environmental Sciences Division, Lawrence Livermore Laboratory. Chapter V, p. 116.

Arbib, R. 1977. "The Blue List for 1978." American Birds 31: 1087-1096.

Bancroft, Hubert Howe. 1866. History of California. The History Company. Vol. 5. San Francisco, California.

Bean, Lowell John and Harry W. Lawton. 1973. Some Explanations for the Rise of Cultural Complexity in Native California, with Comments on Proto-Agriculture and Agriculture. In Patterns of Indian Burning in California: Ecology and Ethnohistory, by Henry T. Lewis, pp. v-xlvii. Ramona, California: Ballena Press Anthropological Papers 1.

Bettinger, Robert and R. E. Taylor. 1974. Suggested Revisions in Archaeological Sequences of the Great Basin in Interior Southern California. Reno: Nevada Archaeological Survey Research Papers 5: 1-26.

Biehler, Shawn. 1976. Dept. of Geology, University of California, Riverside; Riverside, CA. Personal communication.

Black, William E. 1974. A Geophysical Investigation of the Yuha Desert, Imperial County, California: MSc Thesis, University of California at Riverside.

Bolton, Herbert Eugene. 1966. Anza's California Expeditions. New York: Russell and Russell. Vols. 1-3.

Bolton, Herbert Eugene, ed. 1930. Anza's California Expeditions. University of California Press, Berkeley, Vol. 5.

Bondello, Michael C. 1976. "The effects of high-intensity motorcycle sounds on the acoustical sensitivity of the desert iguana, Diposaurus dorsalis." MS Thesis. California State University, Fullerton, CA.

Brattstrom, Bayard and Michael C. Bondello. 1979. "The effects of dune buggy sounds on the telecephalic auditory evoked response in the Mohave fringe-toed lizard, Uma scoparia." Bureau of Land Management Contract (number unknown). Riverside, California.

Brattstrom, Bayard H. 1978. Ambient Sound Pressure Levels in the California Desert, Report to the BLM-DPS Contract #CO-060-CT7-2737-California State University, Fullerton, California.

Butler, Edgar W. and James B. Pick. January 1977. Opinion About Geothermal Development in Imperial County, California: 1976, Dry-Lands Research Institute, University of California, Riverside.

Byrne, S. 1973. "The effects of off-road vehicle use in the Mojave Desert on small mammal populations" in Preliminary Studies on the Effects of Off-Road Vehicles on the Northwest Mojave Desert - A Collection of Papers. K. Berry, ed. Ridgecrest, CA. pp. 64-77.

California Air Resources Board. 1975. California Air Quality Data. Vol. 8, No. 1, p. 32.

California Department of Fish and Game. 1973. State of California Fish and Game Code. California Department of Fish and Game, Sacramento, CA. 339 pp.

California Division of Mines and Geology. 1967. Geologic Atlas of California: Salton Sea Map Sheet. California Division of Mines and Geology, Sacramento, CA.

California Native Plant Society. 1978. Revision of Inventory of Rare and Endangered Plants of California - Southern California. CNPS Rare Plant Project Group. (Unpublished.)

California, State of. July 1, 1976. California City and Unincorporated Place Names. Dept. of Transportation.

California, State of. May 8, 1978. "Population Estimates of California Cities and Counties," Department of Finance, Population Research Unit.

Carter, George F. 1950. Evidence for Pleistocene Man in Southern California. Geographical Review, Vol. 40, No. 1.

Castetter, Edward F. and Willis H. Bell. 1951. Yuman Indian Agriculture: Primitive Subsistence on the Lower Colorado and Gila Rivers. Albuquerque: University of New Mexico Press.

Cheatham, N. H. and J. R. Haller. 1975. "An annotated list of California habitat types." Unpublished.

Childers, W. Morlin. 1974a. Preliminary Report on the Yuha Burial, California. Anthropological Journal of Canada 12(1): 2-9.

_____. 1974b. The Yuha Man: An Interim Report. Paper read at the 1974 Annual Meeting of the Society for California Archaeology, Riverside.

Clavigero, Francisco Javier. 1937. The History of (Lower) California. Translated from Storia della California (Venice, 1789) and edited by Sara E. Lake and A. A. Gray. Stanford: Stanford University Press.

Cline, Lora L. 1979. The Kwaaymii: Reflections on a Lost Culture. Imperial Valley Museum Society, Occasional Paper No. 5, El Centro, California.

Crowell, J. C., ed. 1975. San Andreas Fault in Southern California. California Division of Mines and Geology Special Report 118. Plat 1 (Preliminary Fault and Geologic Map of So. California).

Davidson, E. 1973. "Effects of off-road motocycle activity on Mojave Desert vegetation." in Preliminary Studies on the Effect of Off-Road Vehicles on the Northwestern Mojave Desert - A Collection of Papers. K. Berry, ed. Ridgecrest, CA. pp. 19-44.

Davidson, E. and M. Fox. 1974. "Effect of off-road motorcycle activity on Mojave Desert vegetation and soil." Madrono 22(8): 381-412.

Davis, E. L., C. W. Brott and D. L. Weide. 1969. The Western Lithic Co-Tradition. San Diego Museum Papers, No. 6, San Diego.

Davis, E. L. and Sylvia Winslow. 1965. Giant Ground Figures of Prehistoric Deserts. American Philosophical Society, Preceedings, Vol. 109, No. 1, Philadelphia.

Drucker, Phillip. 1937. Culture Element Distributions: V, Southern California. University of California Anthropological Records, Vol. 1, No. 1, Berkeley.

Dry Lands Research Institute. 1977. "Summary of final reports on geothermal energy development in Imperial County." University of California-Riverside; Riverside, CA.

Dutcher, L. C. et al. 1972. "Preliminary appraisal of groundwater in storage with reference to geothermal resources in the Imperial Valley area, California." U.S. Geological Survey Circular 649.

Edmonds, P. R., H. K. Roffman and R. C. Maxwell. 1975. "Some terrestrial considerations associated with cooling tower systems for electric power generation," in Cooling Tower Environment, 1974. U.S. Energy Research and Development Administration.

Elders, W. A. and S. Biehler. 1975. "Gulf of California rift system and its implication for the tectonics of western North America." Geology, Vol. 3, No. 2.

Elliot, D. G. 1975. "Comparison of Brine Production Methods and Conversion Process for Geothermal Electric Power Generation." Environmental Quality Laboratory, California Institute of Technology. EQL Report No. 10.

Forbes, Jack D. 1965. Warriors of the Colorado: The Yumans of the Quechan Nation and Their Neighbors. Norman: University of Oklahoma Press.

Gibson, J. 1973. "An initial study on the impact of desert motorcycle racing in the Mojave Desert." Department of Biology, California State University, Fullerton, CA.

Gifford, E. W. 1931. The Kamia of Imperial Valley. Washington: Bureau of American Ethnology, Bulletin 97.

Gillette, D. A., I. H. Blifford and Fryear. 1974. The influence of wind velocity on the size distributions of aerosols generated by the wind erosion of soils. Journal Geophysical Research 79:4068-4075.

Hely, A. G. et al. 1966. "Hydrologic Regimen of Salton Sea, California." U.S. Geologic Survey Prof. Paper 486-C.

Hileman, J. A. and T. C. Hanks. 1975. "Seismicity along the San Andreas Fault, Southern California," in San Andreas Fault in Southern California. Crowell, J. C., ed. 1975. California Division of Mines and Geology Special Report 118.

Howard, J. H. 1976. Lawrence Livermore Laboratory; Livermore, California. Personal communication.

Imperial County. 1977. Final Environmental Impact Report for Geothermal Element, Imperial County General Plan. County of Imperial. EIR No. 160-77.

_____. November 1977. Geothermal Element to the General Plan.

Imperial County Planning Department. 1973. Ultimate Land Use Plan. El Centro, CA.

Imperial County Planning Department and California Department of Finance. 1975. "Special census of unincorporated county tabulations by enumeration districts and unincorporated county totals." Sacramento, CA. Department of Finance Computer Printouts.

Imperial Irrigation District and U.S. Department of Agriculture Soil Conservation Service. 1967. General Soil Map. Imperial County, CA.

Ingles, Lloyd G. 1965. Mammals of the Pacific States. Stanford, CA: Stanford University Press. 506 pp.

Jennings, C. W. 1975. Fault Map of California with Locations of Volcanoes, Thermal Springs, and Thermal Wells. Geo Data Map Series Map #1, Cal. Div. of Mines and Geol. Scale 1:750,000.

Johns, R. H. 1954. Geology of the Peninsular Range Province, Southern California and Baja California. California Division of Mines and Geology. Sacramento, CA. Bulletin 170.

Johnson, H. B., F. C. Vasek and T. Yonkers. 1975. "Productivity, diversity, and stability relationships in Mojave Desert roadside vegetation." Torrey Botanical Club. 102(3): 106-115.

Jurek, Ronald M. 1975. "Survey of Yuma clapper rails and California black rails along the Coachella Canal, Imperial County - May 1975." California Department of Fish and Game. Unpublished. 6 pp.

Keefe, J. and K. Berry. 1973. "Effect of off-road vehicles on desert shrubs at Dave Springs Canyon," in Preliminary Studies on the Effects of Off-Road Vehicles on the Northwestern Mojave Desert - A Collection of Papers. K. Berry, ed. Ridgecrest, CA.

Kroeber, A. L. 1925. Handbook of the Indians of California. Washington: Bureau of American Ethnology, Bulletin 78.

Lawrence Livermore Laboratory. 1975a. Geothermal Development of the Salton Trough, California and Mexico. Palmer et al. eds. LLL, UCRL 51775.

EBIT . 1979. Northern California Power Association - Shell Oil Company Geothermal Project No. 2: Noise Effects. Kenneth C. Lamson LLL UCRL 52683.

_____. 1977. Potential Growth of Electric Power Production From Imperial Valley Geothermal Resources. Ermak, D. L. Livermore UCRL-52252.

EBIT . 1975b. Present Status and Future Prospects for Non-electrical Uses of Geothermal Resources. LLL, UCRL 5004-76-1.

EBIT . 1976. Imperial Valley Environmental Project: Progress Report. Phelps and Anspaugh eds. LLL, UCRL 5004-76-1.

EBIT . 1977a. Plan for the Long-Term Assessment of Environmental Quality in Imperial Valley, California, in Relationship to the Development of Geothermal Resources. Livermore, CA. University of California.

EBIT . 1977b. Imperial Valley Environmental Project: Quarterly Data Report. Livermore, CA. University of California.

Layton, David W. 1978. "Water Supply Dilemmas of Geothermal Development in the Imperial Valley of California." Water Resources Bulletin 14: 1. p. 1313.

Leung, P. and R. E. Moore. 1969. "Water consumption determination for steam power plant cooling towers: A heat and mass balance method." Paper presented at the winter annual meeting, American Society of Mechanical Engineers. ASME Paper No. 69-WA-PWR-3.

Loelty, O. J. et al. 1975. Geohydrologic Reconnaissance of the Imperial County, California. U.S. Geological Survey Prof. Paper 486-K, 54 pp.

Lukenbach, R. A. 1975. "What ORV's are doing to the desert." Journal of the California Native Plant Society. 2(4): 3-11.

MacKenzie, F. T. 1975. "CO_2 from fossil fuel adds to biomass," as cited in the LLL-1977 Plan for the Long-term Assessments of Environmental Quality in Imperial Valley, California, in Relationship to the Development of Geothermal Resources. Chemical Engineering News, April 21, pp. 32-33.

McCown, B. E. 1954. Archaeological Survey of (Salton Sea) Beach Line. Archaeological Survey Association of Southern California, Newsletter 1(3): 10-11.

_____. 1955. The Lake LeConte Beach Line Survey. The Masterkey 29: 89-92.

Morton, Paul K. 1977. Geology and Mineral Resources of Imperial County, California. County Report 7, Cal. Div. of Mines and Geol.

Munz, Philip A. 1974. A Flora of Southern California. Los Angeles, CA: University of California Press. 1086 pp.

Pourade, Richard F. 1971. Anza Conquers the Desert. San Diego: A Copley Book.

Powell, W. R., ed. 1974. "Inventory of Race and Endangered Vascular Plants of California." California Native Plant Society, Special Publication No. 1. Berkeley, CA. 55 pp.

Rogers, Malcolm J. 1939. Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas. San Diego Museum, Paper 3.

_____. 1945. An Outline of Yuman Prehistory. Southwestern Journal of Anthropology 1(2): 167-198.

_____. 1966. Ancient Hunters of the Far West. Richard Pourade, ed. San Diego: Union Tribune Publishing Co.

Romney, Evan. 1976. "Ecological problems in the desert ecosystems related to geothermal development at East Mesa," in Potential Effects of Geothermal Development on Imperial Valley Ecosystems. Joseph Shinn, ed. Environmental Sciences Division, Lawrence Livermore Laboratory, Chapter VIII, pp. 1-25.

Ryan, John, Leslie Young and Keith Duke. July 1978. Future Demographic and Economic Trends in the California Desert (draft report), SRI International.

Skrivan, James A. 1977. Digital Model Evaluation of the Groundwater Resources in the Ocotillo-Coyote Wells Basin, Imperial County, California. U.S. Geological Survey, Water-Resources Investigation 77-30.

Snyder, C. T., D. G. Frickel, R. F. Hadley, and R. F. Miller. 1976. "Effects of off-road vehicle use on the hydrology and landscape of arid environments in Central and Southern California. U.S. Geological Survey, Water Resources Investigations. pp. 76-99.

Spier, Leslie. 1923. Southern Diegueno Customs. University of California Publications in American Archaeology and Ethnology 20: 292-358.

Stebbins, R. C. 1974. "Off-road vehicles and the fragile desert." The American Biology Teacher, Part I, 36(4): 203-208; Part II, 36(4): 294-304.

Stewart, G. R. 1971. Rare, endangered, and depleted amphibians and reptiles in California. Herpetology 5: 29-35.

Turner, F. B., P. A. Medical and H. O. Hill. 1978. The status of the flat-tailed horned lizard (Phrynosoma micalli) at nine sites in Imperial and Riverside Counties, California. Bureau of Land Management (Riverside, California) Contract YA-512-CT8-58. 32 pp. + appendices.

USDI, Bureau of Land Management. 1978. Draft E.A.R. for Proposed Geothermal Leasing in the North Salton Sea Area, California. Riverside District Office, BLM. Riverside, CA. 125 pp.

USDI, Bureau of Land Management. 1974. Final environmental impact statement - proposed Barstow-Las Vegas Motorcycle Race. Riverside District Office, CA.

USDI, Bureau of Land Management. 1976. Preliminary Draft - Environmental Assessment Record for Interim Critical Management Program Area #37, Cadiz Valley/Danby Lake. Riverside District Office, CA. p. II-12.

USDI, Bureau of Land Management, 1977. Final Environmental Assessment Record for Interim Critical Management Area No. 37, Cadiz Valley/ Danby Lake. Riverside District Office, Riverside, CA: BLM.

USDI, U.S. Fish and Wildlife Service. 1976. Geothermal Handbook. U.S. Government Printing Office. 194 pp.

Vasek, F. C., H. B. Johnson, and D. H. Eslinger. 1975a. Effects of pipeline construction on creosote bush scrub vegetation of the Mojave Desert. Madrono 23(1):1-13.

Vasek, F. C., H. B. Johnson, and G. D. Brun. 1975b. Effects of power transmission lines on vegetation of the Mojave Desert. Madrono 23(3):114-130.

Vollmer, A. T., B. G. Maza, P. A. Mediea, F. B. Turner, and S. A. Bamberg. 1976. "The impact of off-road vehicles on a desert ecosystem." Environmental Management, Vol. 1, No. 2, pp. 115-129.

vonWerlhof, Jay and Sherilee vonWerlhof. 1977. Archaeological Survey of the Yuha Basin, Imperial County. Unpublished Report, Imperial Valley College Museum, El Centro, California.

vonWerlhof, Jay and Sherilee vonWerlhof et al. 1979. Archaeological Investigation of the Magma Site, East Mesa. Unpublished Manuscript, Imperial Valley College Museum, El Centro, California.

VTN Consolidated, Inc. March 1978. Heber Geothermal Demonstration Project - Final Environmental Impact Report. Imperial County, CA.

Warren, Claude N. 1958. Archaeology of San Diego and Imperial Counties. Archaeological Survey Association of Southern California, Newsletter 5(4): 3-6.

Warren, Claude N. and D. L. Irue. 1961. The San Dieguito Complex and its Place in California Prehistory. Los Angeles: University of California Archaeological Survey, Annual Report 1960-61: 246-337.

Weide, Margaret L. 1973. Archaeological Element of the California Desert Study. Unpublished manuscript on file, Bureau of Land Management, Riverside District, Riverside, California.

Weide, Margaret L. and James P. Barker. 1974. Background to Prehistory of the Yuha Desert Region. Unpublished manuscript prepared for the Bureau of Land Management, California Desert Planning Staff, Riverside, California.

Westec Services, Inc. 1977. Survey of Sensitive Plants of the Algodones Dunes. 141 pp.

Woodward-Clyde Consultants. 1977. Cadiy Valley/Danby Lake, California - Final E.A.R. Riverside District Office, BLM. Riverside, CA. __pp.

_____. 1978a. Impact prediction manual for geothermal development. USDI, Fish and Wildlife Service. FWS/OBS-78/77. 118 pp.

_____. 1978b. "List of Endangered and Threatened Wildlife and Plants." Federal Register 43(238): 58030-58048.

Yuha Unit Resource Analysis. Unpublished Report of Bureau of Land Management. USDI, Riverside, California.

_____. 1973. Urban Geology Master Plan for California. California Division Mines and Geology, Sacramento, CA. Bulletin 198.

_____. 1974. At the Crossroads. California Department of Fish and Game, Sacramento, CA. 112 pp.

APPENDICES

APPENDIX "A"

YUHA SOIL CHARACTERISTICS

- APPENDIX A
YUHA SOIL CHARACTERISTICS

Map Symbol	Soil Name	Natural Drainage	Subsoil Perm	Runoff	Erosion Hazard	Inherent Fertility	Present Land Use
AC	Aco Superstition fine sands, 0 to 2 percent slopes						
	Aco fine sand	Well	Med. Rapid	Slow	Slight to mid wind slight	Medium	Desert Recreation
	Superstition fine sand	Somewhat Excessively	Med Rapid	Slow	Slight	Low	Desert Recreation
BZ	Badland	Excessively		Rapid	High		Desert Recreation
Ca	Carsitas gravelly coarse 0 to 5 percent slopes	Excessively		Slow	Slight	Low	Desert Recreation
Ch	Chuckwalla association, 0 to 5 percent slopes, eroded	Well	Moderately Slow	Rapid	Slight	Very Low	Desert
Cr	Carrizo	Excessive	Rapid to very rapid	Slow	Moderate wind	Low	Desert
GC	Glenbar complex, 0 to 2 percent slopes	Well	Slow	Slow	Slight	High	Desert Recreation

APPENDIX A
YUHA SOIL CHARACTERISTICS (CONT.)

Map Symbol	Soil Name	Natural Drainage	Subsoil Perm	Runoff	Erosion Hazard	Inherent Fertility	Present Land Use
Hv	Holtville silty clay, wet	Well	Slow	Slow	Slight	High	Cropland
IG	Imperial-Glenbar silty clay loams wet, 0 to 2 percent slopes						
	Imperial silty clay loam, wet, 0 to 2 percent slopes	Mod. Well	Slow	Slow	Slight	High	Cropland
	Glenbar silty clay loam, wet, 0 to 2 percent slopes	Mod. Well	Slow	Slow	Slight	High	Cropland
GV	Indio-Vint complex						
	Indio loam	Well	Mod. slow	Slow	Slight	Med	Desert Rec
	Vint loamy very fine sand	Well	Mod.	Slow	Slight	Low	Desert Rec
MF	Meloland fine sand	Well	Slow	Slow	Mud, wind slight water	Med	Cropland
Me	Meloland very fine sandy loam, wet	Well	Slow	Slow	Slight	Med	Cropland

APPENDIX A
YUHA SOIL CHARACTERISTICS (CONT.)

Map Symbol	Soil Name	Natural Drainage	Subsoil Perm	Runoff	Erosion Hazard	Inherent Fertility	Present Land Use
HM	Meloland and Holtville loams, wet						
	Meloland loam, wet	Well	Slow	Slow	Slight	Med	Cropland
	Holtville loam, wet	Well	Slow	Slow	Slight	High	Cropland
Ns	Niland sand	Mod. well	Slow	Slow	Slight	Low	Desert Rec.
NF	Niland fine sand	Mod. well	Slow	Slow	Mod. wind slight wate	Low	Desert Rec.
NL	Niland-Imperial complex, 0 to 2 percent slopes						
	Niland gravelly sand, wet	Mod. Well	Slow	Slow	Slight	Low	Desert Rec.
	Imperial silty clay, wet, 0 to 2 percent slopes	Mod. Well	Slow	Slow	Slight	High	Desert Rec.
RY	Rillito-Laveen complex, 0 to 9 percent slopes						

APPENDIX A
YUHA SOIL CHARACTERISTICS (CONT.)

Map Symbol	Soil Name	Natural Drainage	Subsoil Perm	Runoff	Erosion Hazard	Inherent Fertility	Present Land Use
	Rillito gravelly loamy fine sand, 0 to 9 percent slopes	Well	Mod	Medium	Mod	Low	Desert Rec.
	Laveen loamy very fine sand, 0 to 9 percent slopes	Well	Mod slow	Medium	Mod	Med	Desert Rec.
RS	Rositas sand, 0 to 20 percent slopes	Somewhat Excessive	Mod rapid	Very slow	Slight	Low	Desert Rec.
RSB	Rositas sand, 2 to 5 percent slopes	Somewhat Excessive	Mod rapid	Slow	Mod. wind slight water	Low	Desert Rec.
RO	Rositas fine sand, 0 to 2 percent slopes	Somewhat Excessive	Mod rapid	Slow	Slight	Low	Desert Rec.
RP	Rositas fine sand, wet, 0 to 2 percent slopes	Somewhat Excessive	Mod rapid	Slow	Slight	Low	Cropland Orchard
AL	Rositas*Superstition loam fine sand, 0 to 2 percent slopes						
	Rositas*loamy fine sand, 0 to 2 percent slopes	Somewhat Excessive	Mod rapid	Slow	Slight	Low	Desert Rec.

APPENDIX A
YUHA SOIL CHARACTERISTICS (CONT.)

Map Symbol	Soil Name	Natural Drainage	Subsoil Perm	Runoff	Erosion Hazard	Inherent Fertility	Present Land Use
	Superstition loamy fine sand, 0 to 2 percent slopes	Somewhat Excessive	Mod rapid	Slow	Slight	Low	Desert Rec.
SS	Superstition loamy fine sand, 0 to 5 percent slopes	Somewhat Excessive	Mod rapid	Slow	Slight	Low	Desert Rec.
Vi	Vint loamy very fine sand, wet	Well	Mod	Slow	Slight	Low	Cropland
VM	Vint silt loam	Well	Mod	Slow	Slight	Med.	Desert Rec.

APPENDIX "B"

LIST OF PLANT SPECIES AND THEIR OCCURRENCE
IN VARIOUS HABITAT TYPES

APPENDIX "B"

LIST OF PLANT SPECIES AND THEIR OCCURRENCE IN VARIOUS HABITAT TYPES

	Mesquite Dunes: Agricultural	Mesquite Dunes: Desert	Saltbush: Four-Winged Saltbush	Desert Holly: Barren Sites	Desert Holly: Desert Pavement	Open Desert With Ocotillo	Alluvial Fan With Ocotillo	Creosote Bush Community	Creosote Bush Wash	Smoke Tree Wash	Tamarisk Wash	Desert Buckwheat Wash
Abronia villosa Sand-Verbena	X	X		X			X	X	X	X	X	X
Achyronychia cooperi Frost-mat		X				X	X	X	X	X		
Acacia greggii Catclaw										X		
Ambrosia dumosa Burro-Weed	X	X	X	X	X	X	X	X	X	X	X	X
Aristida sp. Triple-Awned Grass						X				X		
Aristida adscensionis Six-week Fescue	X			X		X	X	X	X	X	X	X
Astragulus sp. Locoweed, Milkvetch								X			X	X
Atriplex canescens ssp. canescens Four-Winged Saltbush	X	X	X	X	X			X	X	X	X	X
Atriplex hymenelytra Desert Holly		X	X	X	X			X	X	X		
Atriplex polycarpa Cattle Spinach, Allscale								X	X			
Baccharis sp.								X	X		X	
Baileya pauciradiata Desert Marigold		X						X		X	X	
Beloperone californica Chuparosa								X	X	X		
Bebbia juncea Sweet Bush						X	X					
Brassica tournefortii					X							
Calandrinia ambigua Pickle Fat		X	X	X				X	X	X	X	X

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	Mesquite Dunes: Agricultural	Mesquite Dunes: Desert	Saltbush: Four-Winged Saltbush	Desert Holly: Barren Sites	Desert Holly: Desert Pavement	Open Desert With Ocotillo	Alluvial Fan With Ocotillo	Creosote Bush Community	Creosote Bush Wash	Smoke Tree Wash	Tamarisk Wash	Desert Buckwheat Wash
Calycoseris wrightii White Tack-stem		x				x	x	x	x	x		
Camissonia sp.				x						x		
Camissonia boothii ssp. condensata Woody Bottle-washer						x						
Camissonia brevipes ssp. brevipes Yellow Cups (wavy leaf)	x	x	x	x		x	x	x	x	x	x	x
Camissonia claviformis ssp. peirsonii Brown-eyed Primrose		x				x		x		x		
Castela emoryi Crucifixion Thorn								x				
Caulanthus hallii	x	x		x			x	x	x	x		
Chaenactis sp.	x							x	x	x		
Chaenactis fremontii								x				
Chaenactis stevioides	x	x		x			x	x	x	x		
Chorizanthe brevicornu ssp. brevicornu Brittle Spine-flower		x		x		x	x	x	x	x	x	
Chorizanthe corrugata Wrinkled Spine-flower			x				x	x	x	x	x	
Chorizanthe rigida Rigid Spiny-herb	x		x	x			x	x	x	x	x	
Chorizanthe spinosa							x	x	x			
Cleomella obtusifolia				x								
Coldenia sp.				x								
Coldenia canescens									x		x	
Coldenia palmeri Mat-veined Leaf	x		x				x	x	x	x	x	
Coldenia plicata			x	x				x	x	x	x	x
Croton californicus var. mohavensis								x		x	x	
Cryptantha sp.	x	x	x	x	x	x	x	x	x	x	x	x
Cryptantha angustifolia						x		x				
Cryptantha micrantha ssp. micrantha Purple-rooted forget-me-not	x					x		x				

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	Mesquite Dunes: Agricultural	Mesquite Dunes: Desert	Saltbush: Four-Winged Saltbush	Desert Holly: Barren Sites	Desert Holly: Desert Pavement	Open Desert With Ocotillo	Alluvial Fan With Ocotillo	Creosote Bush Community	Creosote Bush Wash	Smoke Tree Wash	Tamarisk Wash	Desert Buckwheat Wash
Cucurbita palmata Coyote melon								X	X	X		
Dalea emoryi	X		X	X			X	X	X	X	X	
Dalea mollis								X	X			
Dalea schottii Indigo bush						X		X	X	X		
Dalea spinosa Smoke tree		X	X					X		X	X	X
Datura sp. Jimsonweed								X				
Dicoria canescens										X		
Distichlis spicata var. stricta Saltgrass			X									
Dithyrea californica Spectacle-pod		X										
Encelia farinosa Brittle-bush										X		
Encelia frutescens								X	X	X	X	
Ephedra californica	X	X						X				
Ephedra trifurca	X	X										
Eremalche exilis White Mallow		X										
Eremalche rotundifolia Desert Fivespot	X	X		X		X	X	X	X	X	X	
Eriogonum sp. Wild Buckwheat				X								
Eriogonum deserticola Desert Buckwheat			X					X	X		X	X
Eriogonum inflatum Desert Trumpet				X		X				X		

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Eriogonum pusillum Yellow Turban		x	x	x		x		x	x	x	x	
Eriogonum reniforme Kidney-leaved Buckwheat						x	x	x	x			
Eriogonum trichopes Little Trumpet				x				x				
Eschscholzia glyptosperma Desert Gold-Poppy							x	x	x	x		
Euphorbia sp. Spurge						x		x	x	x		
Euphorbia polycarpa Sand Mat	x		x	x	x	x	x	x	x	x	x	
Eurotia lanata Winter Fat	x					x		x	x			
Fouquieria splendens Ocotillo				x		x	x	x		x		
Geraea canescens Desert Sunflower	x	x	x	x	x		x	x	x	x	x	x
Gilia latifolia				x				x				
Haplopappus acradenius ssp. eremophilus Alkali Goldenbush	x	x	x	x				x	x	x	x	x
Hesperocallis undulata Desert Lily	x	x	x	x		x	x	x	x	x	x	
Hilaria rigida Galleta Grass	x	x	x	x		x	x	x	x	x	x	x
Hymenoclea salsola Cheesebush	x	x					x	x	x	x	x	
Hyptis emoryi Desert Lavender										x		
Krameria grayi White Ratany (Ratney)						x	x	x	x	x		

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	Mesquite Dunes: Agricultural	Mesquite Dunes: Desert	Saltbush: Four-Winged Saltbush	Desert Holly: Barren Sites	Desert Holly: Desert Pavement	Open Desert With Ocotillo	Alluvial Fan With Ocotillo	Creosote Bush Community	Creosote Bush Wash	Smoke Tree Wash	Tamarisk Wash	Desert Buckwheat Wash
Langloisia sp.												
Langloisia schottii				X				X				
Langloisia setosissima	X	X						X	X	X		
Larrea tridentata				X		X	X	X		X		
Creosote Bush	X	X	X	X	X	X	X	X	X	X	X	X
Lycium andersonii												
Anderson Thornbush								X	X		X	
Malacothrix sp.												
Malacothrix sonchoides						X				X		
Yellow Saucers										X		
Mentzelia sp.												
Blazing Star										X		
Monoptilon bellioides												
Desert Star	X	X	X	X		X	X	X	X	X		
Nama demissum												
Purple Mat							X			X		
Oenothera sp.												
Evening Primrose								X		X		
Oenothera deltoides												
Desert Primrose	X	X		X			X	X	X	X		
Oligomeris linifolia												
Linear-leaved Cambess	X	X	X	X	X			X	X	X	X	
Olneya tesota												
Desert Ironwood		X				X		X		X		
Opuntia echinocarpa												
Silver Cholla								X		X		
Opuntia ramosissima												
Pencil Cactus (Pencil Cholla)						X						
Orobanche cooperi												
Palafoxia arida var. arida										X		
Spanish Needles		X		X			X	X	X	X	X	X

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Pectocarya sp. Comb-Bur		X						X				
Pectocarya recurvata Arched-Nutted Comb-Bur	X					X		X	X	X		
Petalonyx thurberi Sandpaper Plant		X										
Phacelia crenulata var. ambigua				X		X		X	X	X	X	
Plantago insularis Indian Wheat	X	X	X	X	X	X	X	X	X	X	X	X
Prosopis glandulosa var. torreyana Mesquite	X	X	X					X	X	X	X	X
Rafinesquia sp.				X								
Rafinesquia neomexicana Desert Chicory								X				
Salvia columbariae var. columbariae								X				
Schismus arabicus	X	X		X	X			X	X	X	X	
Sisymbrium irio London Rocket											X	
Sphaeralcea ambigua Desert Mallow				X				X	X			
Stephanomeria pauciflora Desert Straw				X		X		X	X	X	X	
Stillingia linearifolia								X				
Stillingia spinulosa							X	X		X	X	
Streptanthella longirostris Long-beaked Twist Flower		X					X			X	X	
Suaeda sp. Sea Blite, Seep-Weed		X										
Suaeda torreyana			X	X								
Tamarix sp. Tamarisk	X							X	X	X	X	

APPENDIX "C"

ARCHAEOLOGY: A CULTURAL SEQUENCE OF THE YUHA AREA,
IMPERIAL COUNTY, CALIFORNIA

APPENDIX C

ARCHAEOLOGY: A CULTURAL SEQUENCE OF THE

YUHA AREA, IMPERIAL COUNTY, CALIFORNIA

Although a fully appropriate and highly acceptable cultural sequence remains to be developed for the Yuha Desert, several proposals have emerged that require further testing. The sequence presented here should be viewed as a combination, synthesization and simplification of these proposals. There are five separate cultural components in this sequence: 1) Early Man; 2) San Dieguito; 3) Yuman; 4) Ethnographic Groups; and 5) Historic Activities. Table II-9 compares this sequence proposed for the Yuha with the generally accepted view of a larger regional sequence.

1. Early Man

The date of man's entrance into southern California, and indeed the entire Western Hemisphere, remains controversial. Reasons for this controversy include the sketchy and inconclusive nature of the archaeological data and the absence of appropriate absolute dating techniques. Much debate has been conducted within the archaeological community over several sites and different cultural horizons. Included in this Early Man classification are such proposals as Pre-Malpais, Malpais, and Yuha Man. The lumping together of these different cultural horizons is done because little is known about them and because of the controversy involved, and not because they are unimportant. Indeed, this is one area that is considered extremely important to the understanding of the cultural sequence of the southwest United States.

2. San Dieguito

The earliest accepted cultural pattern in Southern California has been identified as the San Dieguito complex. This occupation relied on hunting and gathering, but apparently food was easily obtained without highly specialized tools. Site types associated with this cultural pattern include small lithic scatters or chipping stations, and isolated tools, many of which are normally situated on rocky terraces and mesas. Many of these sites as well as several of the Early Man manifestations, are also associated with the late Pleistocene Lake LeConte shoreline. The Yuha Desert region contains an extremely large amount of early San Dieguito sites that appear to be the beginning of this cultural horizon in all Southern California (Von Werlhof, 1979, pers. comm.).

3. Yuman

It appears as though there was little, if any, occupation of the study area from the end of the San Dieguito complex to the beginning of the Yuman period. The hypothesis is that an extremely arid environment characterized the area during this time, forcing population movement to the coastal mountain range or the Colorado River.

The Yuman period of occupation has been split into three separate sections, the earliest of which was confined to the lower Colorado River area. Yuman II is characterized by the spread of Yuman ceramic types into the Salton Sink at the same time that Lake Cahuilla filled. The dessication of Lake Cahuilla culminated in the Yuman III period that consisted of an economy based on hunting, gathering, and horticulture. The primary resource areas of this final period were the mesquite hummocks, springs or wells, and the New and Alamo Rivers in Imperial Valley.

4. Ethnography

At the time of white contact, the Kamia inhabitated almost all of Imperial County. Their economy was based on a combination of hunting, gathering, agriculture, and trade. The study area provided mesquite, a highly valued staple, small game, several vegetal and fibrous materials, screwbeans, and a trade corridor to the Southern Diegueno, who lived in the coastal mountains of San Diego County.

The agricultural practices of the Kamia depended upon the annual flooding of the Colorado River that was diverted along the New and Alamo Rivers in south central Imperial Valley. These flood waters usually receded around June, at which time the Kamia planted maize, cowpeas, tepory beans, gourds, watermelon and pumpkins. From the time of the planting until about October, when the crops were ready for harvest, the Kamia probably entered the project area to exploit such staples as mesquite and screwbean.

Located next to the project area to the northeast was the Kamia trade center, Xachupi. Various trade routes to and from this center crossed the area, with Yuha Well used as a stopping place and possibly as a trading center also. Since the area was important as a trade corridor, the location of known trails becomes highly important to our understanding of the Kamia situation.

5. History

The most notable historic event to take place within the study area was in 1774 when a native Indian guide Sebastian Tarabal, led Captain Juan Bautista de Anza and a small party of men to the Yuha Well. De Anza was scouting trade routes from Tubac, Sonora, now Arizona, to Monterey, California. The following year De Anza again visited the well with a large group of soldiers and colonists and 1000 head of cattle. The construction and use of the first road between

Yuma, Arizona and the Pacific Coast comprised the second historic use of the Basin. The Yuma Trail passed east-west through the northern part of study area, and a secondary road was later constructed between the original route and the Yuha Well. Various other historic expeditions traversed the area from the Southeast to the Northwest but are poorly documented. The Yuma Trail remained the major thoroughfare until Highway 80 was routed to the north in 1917.

Key Environmental Factors and Site Types

Several environmental factors have been proposed as keys to the understanding of prehistoric and historic occupation of the area; among these are water, lithic resources, flora and fauna, and habitable areas.

Water is the most important but the least understood of all the factors. Late Pleistocene Lake LeConte has been postulated as having an effect on Early Man and possibly the San Dieguito complex. The date of this body of water and its extent within the basin however, are two areas in which much research remains to be conducted. Our knowledge of Lake Cahuilla, on the other hand, is much more developed. Lake Cahuilla's effect on the Yuman populations is quite evident within the entire valley. Yuha Well has also played an important role in both prehistoric and historic activities in the Yuha Basin.

Lithic resources such as basalt, porphyry, quartzite, chert, chalcedony and jasper have been used by prehistoric populations as raw materials for many tools. Most of these materials are found throughout the project area and many sites are associated with the task of stone tool manufacture.

The amount and distribution of flora and fauna is another key to the understanding of past subsistence patterns. Current knowledge of these resources

applies only to the late prehistoric and historic periods while detailed polynologicla studies will be necessary to reconstruct earliest plant communities.

Habitatable areas are another factor abouth which knowledge is limited. It is believed that since man's first appearance in the area, geological diastrophism has changed the configuration of the earth, and further study in this field will help us determine habitation areas for the early prehistoric period.

APPENDIX "D"

CUMULATIVE ENVIRONMENTAL IMPACT SUMMARY

Table D1. Cumulative Environmental Impact Summary for Yuha/Mt. Signal Proposed Non-Competitive Lease for Geothermal Resource Exploration and Development. Imperial County, California. The Table is a Summary of Yuha Basin Proposed Geothermal Leasing EAR.

Environmental Parameter	Impact Evaluation of Alternatives			Mitigating Measures for Alternatives			Unavoidable Impacts	Severity of Impact Level or Degree of Impact
	Alt I.	Alt. II	Alt. III	Alt. I	Alt. II	Alt. III		
Geology	Production and injection of fluids from & into the geologic formations could have an effect upon seismic activity, surface subsidence and surface uplift	Same	No impact	(1)Seismic monitoring (2)GRO Order 4, 8D (3)Special lease stipulations (4)IV subsidence network monitoring program	(1)Same	None	Unknown: monitoring will assist in understanding	Unknown
Hydrology	The Yuha Basin is a collection point for the southwest drainage area of the West Mesa. The numerous drainages are hazardous during rainy season. Development of geothermal projects will cause surface changes that will change drainage patterns and cause erosion offsite.	Highly sensitive surface locations will not be leased with surface occupancy provisions, thus the impacts will be lessened.	No impact	(1)California Regional Water Control Standards	(1)Same	None	Unknown, insufficient data	Not significant

Table D-1. Continued.

Environmental Parameter	Impact Evaluation of Alternatives			Mitigating Measures for Alternatives			Unavoidable Impacts	Severity of Impact Level or Degree of Impact
	Alt I.	Alt. II	Alt. III	Alt. I	Alt. II	Alt. III		
Soils	The soils of the Yuha Basin generally are easily compacted when wet. Compacted soils tend to lessen the ability of natural foliage to grow.	The amount of surface area impacted by geothermal development will be lessened, thus less chance of compaction.	No impact	(1)Yuha Basin EAR mitigation measure: Alt. Action #1 C 1,2,3,4,5,6, 7,8,9 (2)GRO Order 4 (3)Special lease stipulation	(1)Same	None	Some loss of agricultural land and minor erosion.	Not significant
Air Quality	The production of H_2S gases and dust from geothermal production & construction may impact air quality.	Same	No impact	(1)Yuha Basin EAR mitigation measures Alt. Action #1 D&E 1,2 (2)GRO Order 4	Same	None	Some increase in pollution levels.	Not significant
Visual	High profile projects such as transmission lines & cooling towers & steam plumes will be seen from most KOPs. Low profile projects such as pipelines, roads & drill pads will produce varying contrast levels depending on their proximity to the KOPs.	Areas of high visual quality will be designated for controlled surface occupancy.	No impact	(1)GRO Order 4 (2)Yuha Basin EAR mitigation measures: Alt Action #1, F 1,2,3,4,5	(1)All Alt. I (2)Yuha Basin EAR mitigation measures & Alt. Action #2 visual resources.	None	Some change in visual quality	Not significant

Table D-1. Continued.

Environmental Parameter	Impact Evaluation of Alternatives			Mitigating Measures for Alternatives			Unavoidable Impacts	Severity of Impact Level or Degree of Impact
	Alt I.	Alt. II	Alt. III	Alt. I	Alt. II	Alt. III		
Recreation	The Yuha Race course & pit areas lie entirely within the study area. Roads and pipelines could conceivably cut across the course.	The Yuha race course will be considered a high value resource and protected from intrusion.	No impact	(1)Yuha Basin EAR mitigation measures Alternative Action #1 H, 1,2	(1)Same as Alt. I (2)Yuha Basin EAR mitigation measures Alt. Action #2 Recreation 1,2	None	Some decrease in use	Alt 1 moderate Alt 2 not significant
Socio-Economics	Impacts considered to be a positive increase of the economic base.	Same	Impact considered to be a reduction in available geothermal development within the region, thus an overall reduction to base economy.	(1)Yuha Basin EAR mitigation measures Alt. Action #1 I, 1,2,3	(1)Same	None	Some positive effects in economic base.	Alt. 1&2 positive Alt. 3 not significant
Land Use	Could impact Yuha MFP Decisions #37, #48 & #46 (see Recreation). Could alleviate the use of known fertile soils for agricultural production.	Will provide for a greater diversity of land use types supporting the multi-use policy of BLM.	No impact	(1)Yuha Basin EAR mitigation measures Alt. Action #1 J 1a or 1b.	(1)Same (2)Yuha Basin EAR mitigation Alt. Action #2 Land Use 1,2	None	A new land use will be introduced. One of a man-made nature and permanent	Alt. 1 moderate Alt. 2 not significant

Table D-1. Continued.

Environmental Parameter	Impact Evaluation of Alternatives			Mitigating Measures for Alternatives			Unavoidable Impacts	Severity of Impact Level or Degree of Impact
	Alt I.	Alt. II	Alt. III	Alt. I	Alt. II	Alt. III		
Noise	Noise levels during exploration and construction are short lived but highly intense reaching levels of 100 dBA and higher. Noise levels during plant operation are long term and might affect wildlife outside plant site (see flora and fauna).	The noise levels will be the same; however highly sensitive areas will not be leased with provision for surface occupancy.	No impact	(1)GRO Order 4 (2)Yuha Basin mitigation measures Alt. #1 K 1,2,3,4,5	(1)Same as Alt. 1 (2)Alt. Action #2 noise mitigation 1 & 2	None	Some increase in ambient noise level	Alt 1 significant Alt 2 not significa
Cultural	The majority of cultural resources are surface manifestation and are extremely fragile and nonrenewable.	Areas of high sensitivity, well identified and not leased with provisions for surface occupancy.	No impact	(1)GRO Order 4 (2)Standard lease (3)Yuha Basin EAR mitigation Alt. #1, L 1,2,3	(1)Same Alt. 1 (2)No surface occupancy on identified highly sensitive resource site.	None	Some loss of cultural information	Alt. 1 moderate to potentially significant Alt. 2 not significant
Flora and Fauna	Loss of vegetation and habitat, disruption of wildlife behavior, and	Through an identification of and the limiting of surface occupancy in	No impact	(1)GRO Order 4 (2)Standard lease stips. (3)Yuha Basin EAR mitigation Alt.#1 M	(1)Same Alt. 1 (2)No surface occupancy on identified highly sensitive	None	Some loss or displacement of wildlife and vegetation	Alt. 1 moderate Alt. 2 not significant

Table D-1. Continued.

Environmental Parameter	Impact Evaluation of Alternatives			Mitigating Measures for Alternatives			Unavoidable Impacts	Severity of Impact Level or Degree of Impact
	Alt I.	Alt. II	Alt. III	Alt. I	Alt. II	Alt. III		
Flora and Fauna (Cont.)	possible physiological changes caused by noise and human activities crushing of wildlife & vegetation by vehicles, lowering of water table influencing plant and wildlife survival	sensitive flora and fauna resource sites, the impacts upon these fragile resources will be greatly reduced.		1,2,3,4,5,6	resource sites.			

Table D-2. The Level-of-Significance Represented by each of the 10 Criteria Listed in 40 CFR 1508.27 for the Proposed Non-Competitive Lease of Federal Lands in the Yuha Basin, Imperial County, California.

Key - NI - No Impact
NS - No Significant Impact
MI - Moderate Impact

40 CFR 1508.27 Criteria	Alt. I	Alt. II	Alt. III
1. Beneficial and/or Adverse Effects	NS	NS	NS
2. Public Health and Safety	NS	NS	NI
3. Unique Characteristics of the Geographical Area	NS	NI	NI
4. Effect Highly Controversial	NI	NI	NI
5. Highly Uncertain Effects or Unique or Unknown Risks	NS	NS	NI
6. Establishes Precedent for Future Actions or is a Decision in Principle About Future Action	NI	MI	NI
7. Assessment of Cumulative Actions and Impacts	MI	NS	NS
8. Effect on Districts, Sites, Highways, Structures, or Objects Listed in or Eligible for Listing in the National Register or Historic Places or may Cause Loss or Destruction of Significant Scientific, Cultural, Historical Resources	MI	NS	NI
9. Effects on Endangered or Threatened Species or Their Habitat that have been Determined to be Critical Under the Endangered Species Act of 1973	NS	NS	NI
10. Threatens a Violation of Federal, State, or Local Law or Requirements Imposed for the Protection of the Environment	MI[1/]	NS	NI

1/ This alternative, if implemented, would potentially conflict with the (1) general land-use plan for Imperial County and gecthermal element, (2) possible non-compliance with 36 CFR Chapter 800 and, (3) modification to flat-tailed horned lizard (Stated listed) habitat.